THE REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

VOL. IV.

ISSUED BY THE IMPERIAL
BUREAU OF ENTOMOLOGY.

LONDON:
SOLD BY
THE IMPERIAL BUREAU OF ENTOMOLOGY,
89, QUEEN'S GATE, LONDON, S.W. 7.
1916.

IMPERIAL BUREAU OF ENTOMOLOGY.

REVIEW

OF

APPLIED ENTOMOLOGY.

SERIES A.

VOL. IV.] [1916.

EDITORIAL.

To many persons it may come as a surprise that, in spite of the terrible war which has affected every quarter of the globe and paralysed scientific research in so great a part of Europe, the output of publications dealing with Economic Entomology has actually shown a marked increase during 1915. This increase is even greater than would appear from the pages of the *Review of Applied Entomology*, for it has been impossible for us to obtain access to the great majority of scientific periodicals that have appeared in hostile countries. In this connection, the following table showing the number of articles abstracted in the *Review* during the last three years, grouped under the countries in which they were published, may be of interest.

NUMBER OF ABSTRACTS PUBLISHED IN THE FIRST THREE VOLUMES, BOTH SERIES.

Country of Publication.	*1915.*	*1914.*	*1913.*
Africa, British (including Egypt)	41	97	48
Africa, other than British	18	28	18
Australasia	81	43	39
Austria-Hungary	4	11	9
Canada	99	41	41
Central and South America	30	51	25
Denmark	3	–	–
East Indies, Hong Kong, Saigon, etc.	53	30	41
France	97	202	147
Federated Malay States	10	–	–
Germany	25	117	65
Great Britain	227	160	144
Hawaii	19	–	–
Holland and Belgium	11	19	25
India and Ceylon	43	65	43
Italy	73	58	43
Russia	318	192	72
Scandinavia	23	5	1
Spain, Portugal and Colonies	6	7	10
Switzerland	5	10	12
United States	543	315	231
West Indies	44	43	23
	1,773	1,494	1,037

(C231) Wt.P12/91. 1,500. 1.16. B.&F.Ltd. Gp.11/3.

Under the system which has now been adopted, it is hoped that, in future, each part will contain the abstracts of the papers which have been received up to within some eight weeks of the date of publication. Thus the present part published at the end of January 1916, contains all the matter received during November 1915. It is hardly practicable to bring the contents of the *Review* more up to date than this, in view of the time necessarily occupied in preparing, editing and printing the abstracts.

Up to the present, only a short index of names has been issued with the volumes of Series A, but it is hoped to publish during the present year a complete subject index to the contents of the first three volumes. It is estimated that this index will contain nearly 250 pages, and it will not be included under the current annual subscription, but will be sold separately at a charge of five shillings, post free.

It is proposed, however, to issue a complete subject index with the present and future volumes of Series A, similar to that already issued with Series B, for which no extra charge will be made.

All inquiries relating to this index should be addressed to the publishers, Messrs. DULAU & Co., 37, Soho Square, London, W.

KEMNER (N. A.). **Rapssugaren** (*Eurydema oleracea*, L.)—*Medd. från Centralanstalten för Försöksväsendet på Jordbruksområdet*, no. 122. Entomologiska Avdelningen, no. 23, *Stockholm*, 1915, 13 pp., 5 figs.

Eurydema oleraceum has done considerable damage of late years in several parts of Sweden. It was known as a pest by Linnaeus, who described an outbreak of it in 1760. Cabbage and turnips are preferably attacked, but occasionally also potatoes, cereals and ornamental plants. The adult hibernates under vegetable refuse, which should be destroyed. In May and June the females deposit their eggs on the leaves in characteristic clusters. The egg-stage lasts about one month, and the new brood is full-grown in late summer. Collecting and spraying are recommended as methods of controlling *E. oleraceum*, and according to Lampa, a 4 per cent. solution of lysol is very effective, killing the insects in a few minutes. As spraying is apt to injure the tender shoots, it must be applied with caution. The best result is obtained from two sprayings with an interval of from 3 to 10 minutes.

Larvenfrass in Kiefernforsten im Spätherbst. [Larval frass in pine woods in late autumn.]—*Deutsche Landwirtschaftliche Presse, Berlin*, xlii, no. 89, p. 761, 1 fig.

Outbreaks of *Lophyrus pini* (pine sawfly) are reported from many parts of Brandenburg and Silesia. Spraying with petroleum soap emulsion and the collection of the larvae are the best means of control. On an estate near Danzig, in 1905, about 150 acres were cleared of 1,412 litres of larvae (=5,600,000 individuals) at a cost of about £8 16*s.* 0*d.*; in 1906, about 75 acres were cleared of 201 litres (=800,000 individuals) at a cost of about £1 7*s.* 0*d.*

ESSIG (E. O.). **Aphididae of California.** xi.—*Jl. Entom. Zool., Claremont, Cal.*, vii, no. 3, September 1915, pp. 180-200, 9 figs.

Lachnus glehnus, sp. n., often occurs in great numbers on *Picea glehni*, Mast. (Japanese dwarf silver spruce). The trees upon which this species was found were imported from Japan and it is possible that the insect was imported with them. *Phyllaphis coweni*, Cockerell, is common on the leaves of manzanita, producing conspicuous red galls during late summer and early autumn, which are the result of the attacks of the stem-mothers. The distribution of this species is wide and apparently coincides with that of the food-plants. It occurs in the Rocky, Sierra Nevada and Coast Range Mountains. In California this Aphid is probably most abundant in August. The most important natural enemy is an Anthocorid bug. *Callipterus bellus*, Walsh, occurs on the undersides of the leaves of *Quercus agrifolia*, in the southern part of the State. In the eastern States, this species has been taken on *Q. rubra*, *Q. coccinea*, *Q. macrocarpa* and *Q. alba*.

BOAS (J. V. E.). **En ny fiende af Graesfrö-Avlen.** [A new enemy of the cultivation of grass seed.]—*Ugeskrift for Landmaend*, lx, no. 43, 28th October 1915, pp. 594-596, 4 figs.

During the summer of 1915, the larvae of *Luperina* (*Apamea*) *testacea* appeared in several localities in Denmark and injured grasses, such as *Festuca elatior*, at Roskilde in July, oats at Lyngby in May, and *Dactylis*

glomerata at Stevns in September. This moth has only been reported as doing damage once previously, viz. in the Netherlands on *Triticum repens*. The larva lives in the ground, like other cut-worms, and remains hidden during the day, when it gnaws the roots; it appears on the surface during the night and injures the stems of the grass immediately above the surface of the soil.

There seems to be no effective remedy against this pest; as it feeds on several grasses, as well as on cereals, rotation of crops is consequently quite useless. It is not, however, advisable to utilise the injured areas for the cultivation of grass seed until after an interval of some years. The larvae pupate in July, and the moths appear in August and September. The eggs are probably laid in the soil, and the young larvae hibernate.

SMITH (H. E.). **The Grasshopper Outbreak in New Mexico during the Summer of 1913.**—*U. S. Dept. Agric., Bur. Entom., Washington, D.C.*, Bulletin no. 293, 7th October 1915, 12 pp.

An unusual invasion of *Dissosteira longipennis* occurred in the Pecos Valley of New Mexico in the summer of 1913. The insect has been known in the U.S.A. since 1872, especially in Colorado and Kansas, where of late years the outbreaks have occasionally been very serious; it is now known in most of the Western States. In New Mexico hatching *en masse* began in the first week of May, a few adults were seen on 4th June and by 24th June the majority had become adult; there is apparently only one generation in the year, oviposition taking place late in August or early in September. Kellogg stated in 1892 that, in Kansas, this grasshopper is non-migratory, but in 1913 from 4th May to 24th June droves of nymphs travelled 15 to 18 miles in a north-easterly direction destroying all the prairie grass in their path. The species is gregarious and readily attracted by lights. The particular outbreak dealt with originated in a huge swarm of adults from the north, which settled near Elida, New Mexico, at the end of August and beginning of September. The swarm moved off to a chain of sandhills 8 to 10 miles long, running north-east and south-west of Elida; the young hoppers were observed on 4th May, and during a heavy shower, some of the areas of the breeding ground were covered 6 inches deep with them; a few egg-masses were laid on hard land. This species has a preference for massing together and travelling over barren areas such as roadways, footpaths, railways, etc. Droves 1 or 2 miles long and moving at from 8 to 20 feet per minute, according to the age of the insects were common. Adults fly with the wind if it be strong, but generally face it in order to rise from the ground to the desired altitude, usually 30–40 feet; they have been seen to alight on water and to take wing again easily from it. The feeding hours are generally from dawn till 8 or 9 a.m. and again from 3 to 4 p.m.; there is little or no feeding at night. The food-plants most favoured are grama grass, buffalo grass, mesquite grass, maize, kafir corn and millet. Millet is greatly favoured, sorghum being less attractive; all market-garden plants are devoured and even Russian thistle (*Salsola tragus*) and soapweed (*Chlorogalum pomeridianum*) may be eaten; lucerne seems to be unsuitable, nymphs confined on it in a cage having died, apparently from starvation.

Various birds, lizards, toads and prairie-dogs feed on the insects. The most important controlling factor is the fly, *Sarcophaga kellyi*, Ald., which deposits its minute maggots on the dorsum of the pronotum of the freshly moulted nymphs; from one nymph, 6 individuals of the parasite were reared. Larviposition never takes place on a moving nymph or flying adult, but generally, so far as could be observed, after the nymphs had been rendered comatose by the sting of the Sphegid wasp, *Prionoxyx atrata*, Lep. The larvae of *S. kellyi* pupate from half an inch to 2 inches below the surface of the soil, but probably those of the autumn, hibernating generation enter the soil to a much greater depth. There are several generations in the year and there were certainly two, if not three, from early in May to the middle of July. The wasps were always present in large numbers among the hoppers, and though the females sting several, it is only the last one which is carried off to the burrow and the others never recover; the hopper is very rarely able to resist the attack, though it may attempt to do so. The mode of construction of the burrows is described in detail and also the behaviour of a Bembecid wasp, *Megastizus unicinctus*, Say, which robs *Prionoxyx* of its prey after it has been placed in the burrow; the chief harm done by this secondary parasite is the destruction of the eggs of *Prionoxyx*, which is deliberate and effected by crushing between the mandibles.

Among artificial methods of control, poisoned bran mash is recommended, consisting of wheat bran 25 lb., Paris green 1 lb., 2 quarts cheap molasses and the juices of the finely ground skin and pulp of 3 oranges or lemons; this quantity will suffice for from 5 to 10 acres, if sown broadcast before dawn in strips 1 rod apart. The results are very good, as many as 75 hoppers per square foot having been counted after its use. Coarse, flaked bran and Paris green containing not less than 55 per cent. of arsenic should be used; arsenate of lead should not be used. So far as the author's observations go, the result is equally good whether oranges or lemons be employed. Though no trials were made, as the nymphs are voracious feeders on horse dung, Criddle mixture would probably be equally effective. A list of 15 works bearing on the subject is appended.

Apples Affected with Woolly Aphis.—*Gardeners' Chronicle, London*, lviii, no. 1509, 27th November 1915, p. 344.

The transplanting of apple trees infested with woolly aphis [*Eriosoma lanigerum*] is not recommended. Fumigation with cyanide does not destroy the Aphids which shelter in crevices of the bark, nor does it affect the eggs. The best method is to spray or paint the trees with lime-wash, 1½ cwt. to 100 gals. water. The lime should be slaked in the orchard, a little at a time, and applied hot. This treatment should kill adults and eggs. If any insects appear in spring or summer, the colonies should be painted once a week with crude methylated spirit. It is not advisable to dress the land with flowers of sulphur, as a heavy dressing might injure young trees.

Gibson (A.). **Locust control work in Eastern Canada in 1915.**—*Agric. Gaz. Canada, Ottawa,* ii, no. 10, October 1915, pp. 937-940, 2 figs.

Young locusts began to appear in noticeable numbers towards the end of May. In Ontario and Quebec the insects occurred in June in exceptional numbers, the chief damage being done by *Melanoplus atlantis* (lesser migratory locust). The modified Kansas bait formula was used, consisting of :—Bran, 20 lb.; Paris green, 1½ lb.; molasses, 2 quarts; oranges, 3; water, 2½ gals. The farmers of St. Etienne, Quebec, co-operated with one another and the 20,000 acres of this parish were treated with the poison bait in the week beginning 4th June. When the author visited the locality on 23rd June, locusts could only be seen in one or two small areas owned by an outside corporation. The farmers appreciated the results very highly, for many farms had been abandoned owing to the complete devastation caused by the locusts in previous years. Sandy areas that had been reclaimed had reverted to the original condition, as the locusts had destroyed all grasses and vegetation which kept the sand from drifting. Old pasture or meadow land known to attract locusts for oviposition should be ploughed at least 6 inches deep after the eggs have been laid, either in late autumn or in spring before May.

Nova Scotia: Notes.—*Agric. Gaz. Canada, Ottawa,* ii, no. 10, October 1915, pp. 977-978.

Only six cases of San José scale [*Aspidiotus perniciosus*] have been located this year by the provincial inspectors, and these were found on plants imported prior to the inauguration of the government inspection of nursery importations in 1912, not a single case being met with on subsequent importations. The comparative figures are very striking. In 1912, 750 cases were discovered; in 1913, 64; in 1914, only 4, and in 1915, only 6 cases to date, and these all on plants imported prior to 1912.

Chrystal (R. N.). **Notes on *Lithocolletis gaultheriella*, Wals. (Leaf-miner in *Gaultheria shallon*).**—*Proc. Entom. Soc. British Columbia, Victoria,* no. 6, June 1915, pp. 111-114, 1 fig.

Gaultheria shallon, a shrub which is plentiful in the coast region, is attacked by the leaf-miner *Phyllorycter* (*Lithocolletis*) *gaultheriella*. The mines occur near the upper side of the leaf. The first pupae were collected on 18th July; these changed to adults on 20th and 21st July. At the time of pupation the leaf becomes puckered up and the pupa is found attached to its surface by a thread. A later brood hibernates in the adult stage. The larval and pupal stages are described.

Mason (C.). **Report of the Entomologist for the year ending 31st March 1915.**—*Dept. Agric., Nyasaland Protectorate, Zomba, Nyasaland,* 29th April 1915, 16 pp. [Received 5th November 1915.]

Beetles of several families were observed on cotton. The Cetoniid, *Plaesiorrhina trivittata*, Sch., was common and the Chrysomelid, *Ootheca mutabilis*, Sahlb., fed on the leaves early in the season. A flea-beetle which occurred in December and January on the leaves of peas, maize

and ground-nuts, appeared later on cotton, damaging the leaves and bolls. The weevil, *Apion armipes*, Wagn., was less abundant than in previous years. The larva rings the bush about one inch above the ground, causing the leaves above to turn red. Termites invariably complete the destruction of the plant; attacked plants should be cut out and burned.

Of the Lepidoptera, *Diparopsis castanea*, Hmp., (red boll-worm). is at present the most serious pest of cotton in Nyasaland. The duration of the stages in the life-history observed in 1914–15 were:—Egg-stage, 2–5 days; larval, 23–38 days; pupal, 13–49 days. The eggs are laid singly on young shoots. The larvae feed for some days on the outside of the boll or on the bracts, then enter the boll and complete the larval stage. Pupation takes place in the soil. Wild Malvaceae are probably the native food-plants. A predaceous wasp and a bacterial disease have been recorded, but no Hymenopterous parasite of this species was found. A single Tachinid fly was reared from several hundred larvae. Hand-picking early in the season and frequent hoeing are recommended. *Chloridea obsoleta*, F., appears to be increasing in importance in the Protectorate. Its omnivorous habits, great fecundity and apparent freedom from parasites are all favourable to its increase. The egg-stage occupies from 6 to 10 days, the larval, from 18 to 35, the pupal, from 15 to 25 days. The second brood, occurring at the end of February and in March, is the most destructive. The marked preference shown for the chick pea indicates that a trial of this plant as a trap-crop is advisable. *Prodenia litura*, F., was abundant in February and March. *Earias insulana*, Boisd., is generally distributed. The following extremes in the life-cycle were observed:—Egg-stage, 4–8 days; larval, 16–28 days; pupal, 14–19 days. The most serious damage occurred in December and January, when the cotton was about 8 inches high. Infestation was most severe in low-lying districts, possibly owing to the absence of natural controls. The food-plants noted were *Hibiscus*, mulberry, and *Eriodendron*. The only parasite observed was a Braconid, perhaps a species of *Rhogas*. *Sylepta derogata*, F., was abundant at the south-west end of Lake Nyasa, especially during March. The durations of the stages of this leaf-roller are:—Egg-stage, 3–6 days; larval, 17–29 days; pupal, 6–18 days. Two Chalcid parasites have been reared from it. In the Shiré Highlands two small Braconids occurred in about 1 per cent. of the larvae and a predaceous Eumenid wasp is known to attack them. *Tortrix* sp. (cotton shoot webber) occurred in January and the second brood in March. The leading shoot was usually attacked, the larvae feeding on the young leaves, unopened flowers and bolls, frequently gnawing the stem and so causing the shoot to curl. The larval stage is about 28 days, the pupal, 8–11 days. For *Tortrix* and *Sylepta*, hand-picking is recommended. *Acrocercops bifasciata*, Wlsm. (cotton leaf-miner) was abundant on a plot of late-planted cotton. This insect was also reported on the low-lying river plantations and may be a pest of some importance. The eggs are laid on the under surface of the leaf. The larvae penetrate the tissues, where they remain until mature. Pupation takes place on the outside of the leaf or stem, occasionally on the surface of the soil at the base of the host plant. The larval stage lasts from 25 to 32 days, the pupal, from 5 to 7 days. No parasites or predaceous

enemies are known. The following Lepidoptera were also observed on cotton:—*Hypolimnas misippus*, L., *Catopsilia* sp., *Acontia graellsii*, Feisth., *Ophiusa* sp., *Anomis erosa*, Hb., and several NOCTUIDAE.

Among the Rhynchota, three species of cotton-stainers are well-known in the Protectorate, viz.—*Dysdercus nigrofasciatus*, Stål, *D. intermedius*, Dist., and *Oxycarenus* ? *hyalinipennis*, Costa. *Dysdercus* spp. were prevalent from October to March. The native food-plants are probably *Hibiscus* and other Malvaceae. Eggs are laid in rubbish or in cracks in the soil. The egg-stage of *D. intermedius* lasts from 12 to 18 days. The larvae suck the plant-juices or the seeds in the bolls. Reproduction can be delayed for a long time when food is scarce. A Tachinid parasite of *D. intermedius* is known. A Reduviid bug [*Phonoctonus nigrofasciatus*, Stål] is predaceous on both species. Small heaps of cotton-seed are excellent traps. The use of cotton-seed as manure is largely responsible for early broods in November and December. Well-rotted seed apparently does not attract the insects. *O.* ? *hyalinipennis* was abundant late in the season. The Coreid bug, *Anoplocnemis curvipes*, F., was important during January and February, causing the death of numerous young shoots. Eggs and nymphs, probably of this species, were found in abundance on cotton plants and in all probability the whole life-cycle is passed there. Other food-plants observed were sunflower, *Dahlia*, *Hibiscus*, mango, *Ficus*, *Brachystegia*, mahogany and wild Leguminosae. MEMBRACIDAE, JASSIDAE, *Aphis gossypii* and *Aphis* sp. were also observed on cotton.

No very serious pest of tobacco was reported. *Prodenia litura*, F., was present in some localities, three broods being observed up to the end of March. The larvae also occurred on cotton, sunflower, mustard, maize, etc. Natural control is apparently slight. One Hymenopteron was bred from a larva on cotton in January. In March a few specimens of the Ichneumon, *Metopius discolor*, Tosq., were reared. The larvae in tobacco fields are eaten in considerable numbers by crows. In nurseries, spraying with lead arsenate or hand-picking the egg-masses are effective control measures. Observations in Nyasaland have shown that the larvae feed during the day and hand-picking can thus be performed at any time. *Phthorimaea heliopa*, Low. (tobacco stem caterpillar), *Lasioderma serricorne*, F., cut-worms and *Hippotion celerio*, L., were recorded on tobacco in some situations.

Maize was chiefly attacked by borers of several species, though damage to the leaf, cob and tassel also occurred. The Noctuid, *Busseola fusca*, Hmp., deposits its eggs on the young shoots. The larvae feed first on the leaves and then bore down the stem. This insect can be largely controlled by topping as soon as the damage to the young leaves is observed. A Cerambycid beetle was also a common borer of maize. The cob was attacked by *Chloridea obsoleta*, *Cirphis loreyi*, *Eublemma* sp., a Tineid and two Pyralids. *Calandra oryzae*, L. (rice weevil) was abundant on ripening cobs in March. Individual cobs with short sheaths appeared to be more affected by insects than those with a long sheath. The latter type should therefore be chosen in seed selection. Various ARCTIIDAE and LYMANTRIIDAE injured the cob and leaves. Termites were present in some isolated patches of maize. A Fulgorid, an Aphid and the ear-wig, *Diaperasticus* (*Elaunon*) *erythrocephalus* caused minor damage.

All maize pests, with the exception of cob and tassel insects, also attacked broom-corn (sorghum) severely. An Acalyptrate Muscid appeared early in the season, injuring the growing point, about 79 per cent. of the growing shoots being destroyed by the first brood. Wheat, barley, oats and rye were severely injured by termites. Grasshoppers were reported as serious pests of wheat in the Fort Johnston district; various CANTHARIDAE attacked the anthers.

Among the minor crops, mustard and other Cruciferae were damaged by the larvae of a species of *Athalia*, *Plutella maculipennis*, Curt., and *Laphygma* (*Caradrina*) *exigua*, Hb. *Chloridea* sp., a Pyralid, and *Anoplocnemis curvipes*, F., were present on sunflowers. This plant should prove useful as a trap-crop for *A. curvipes*, when the latter occurs on cotton. *Chloridea obsoleta* and *Prodenia* were recorded on hemp. *Ootheca mutabilis*, Sahlb., was the most serious pest of peas and beans. Stored grain suffered from most cosmopolitan grain insects, except *Calandra granaria*. Ground-nuts were severely injured by Pyralid larvae [*Ephestia elutella*], there being several broods during the season. This species was parasitised by a Braconid. Mango, peach and pineapple were affected a few days before ripening by DROSOPHILIDAE. Peaches at the end of the season were attacked by CETONIIDAE one of which, *Plaesiorrhina trivittata*, Sch., has a second brood in March which injures cotton, while the second brood of two other species feeds on a wild Composite, as well as on cotton-bolls. A boring Lepidopterous larva was common in ripening peaches in the Mlanje district. Mulberry was attacked by two scale-insects, of which *Aulacaspis* (*Diaspis*) *pentagona*, Targ., was of importance. *Aphis citri*, Ashm., occurred on lemons in some localities. *Papilio demodocus*, Esp., was abundant from October to March in the southern portions of the Protectorate. The caterpillar is parasitised by a Braconid. It can be readily controlled by hand-picking. The most important pests of mahogany were *Heteronygmia leucogyna*, Hmp., and *Mussidia albipartalis*, Hmp. [see this *Review*, Ser. A, ii, p. 340]. *Psylla* was recorded on nursery stock. *Anthores leuconotus*, Pasc. (grey borer) was prevalent in old coffee plantations from November until January. *Hibiscus* was attacked by many cotton pests, including *Earias* sp., *Dysdercus intermedius*, etc. The most serious pest was the Buprestid, *Pseudagrilus splendidus*, Castn. The larva of this species bores into the stem and twigs of *Hibiscus*, and in the case of young plants may bore the tap-root. The larvae reach maturity in 8 weeks. The pupal stage lasts 30 days. The first brood was observed in November, the second in February and March. Affected twigs should be removed below the point of attack, while badly infested plants should be pulled up and burnt.

DASH (J. S.). **Report on Entomological and Mycological Work.**—*Rept. Dept. Agric., Barbados for 1913-14, Barbados*, 1915, pp. 37-43. [Received 2nd November 1915.]

The largest consignment of cotton seed ever imported, which consisted of 4,881 bags from Colombia, was fumigated by the Clayton method with sulphur dioxide; fragments of what appeared to be portions of cotton-stainers were found in some of the bags opened, but no living insects. *Phytalus smithi* was observed to be on the increase and there was a more or less corresponding diminution in

numbers of its Scoliid parasite, *Tiphia parallela*; efforts are being made to propagate the latter in various parts of the island. Grubs of *Diaprepes abbreviatus* have been found 3 feet below the surface in moist clay. The grubs leave the cane roots, when they begin to dry after the cane is cut, in search of moisture. Unless therefore, as has been insisted on before, the roots are removed as soon as the cane is cut, the grubs will not be removed with them. It is now clearly proved that the life of the grub may extend to 300 days and rotation is suggested, but as the grubs also attack cotton and sweet potato, the question of a suitable crop requires further consideration.

In the field the pupal stage is very short. The collection of beetles and egg-masses by hand is being steadily carried on, and though rather costly, the results obtained justify the expense; the price is arranged according to prevalence, so that a reasonable wage may be earned. No effective parasites have been discovered. A few examples of *Exophthalmus esuriens* have been found feeding on *Agave*; this is the first record for Barbados. Other pests of sugar-cane, *Diatraea saccharalis*, *Sphenophorus sericeus*, *Pseudococcus calceolariae* and *P. sacchari*, were not more numerous than usual. Termites did great damage on one estate. Red spiders attacked sweet potatoes and *Laphygma frugiperda* was the only serious pest of maize; corn meal poisoned with Paris green dropped into the middle of the rolled up leaves of young plants was a useful remedy. A species of *Mytilaspis* was collected from cassava. Lime-sulphur paint has been used with marked success against *Chionaspis citri*; the formula is as follows: Sulphur 2 lb., unslaked lime 1 lb., water 2 gallons, boiled for an hour and a half; 3 lb. more lime is then added and the mixture boiled again for half an hour, and made up to 2 gallons; sufficient flour or fine clay must be added to make it of the consistency of thin paint; it is applied with a brush. This paint not only kills the scales, but has a very cleansing effect on the trees.

STRATFORD (G.). **Tests of Spraying-Compounds: Lime-Sulphur.**—*Jl. Agric., Wellington, N.Z.*, xi, no. 3, 20th September 1915, pp. 243-247. [Received 15th November 1915.]

This is a report on the tests made in the Nelson district and continues a previous article on the testing of lime-sulphur [see this *Review*, Ser. A, iii, p. 736]. The results are shown in a series of tables. Strengths of 1 to 60, 1 to 80 and 1 to 100 were used; one of the brands tested was 33° Bé. and another 23° Bé. While some apple trees will stand a much stronger spray than others, tender varieties such as Jonathan and Cox's Orange Pippin are very susceptible to injury. It is therefore better to take the strength of 1 to 80 as a standard and even sprayings of 1 to 100 have given excellent results. In the course of spraying pear trees, it was noticed that while the trees were quite clean and healthy after two applications, the third one scorched the foliage considerably.

RICHARDS (P. B.). **Methods and Materials for the Control of Insect Pests. Part VII.**—*Agric. Bull., Fed. Malay States, Kuala Lumpur*, iii, no. 11, August 1915, pp. 429–436. [Received 19th November 1915.]

This paper deals with resin compounds, kerosene emulsions and sanitary fluids, and their use as contact poisons. For the preparation

in small quantities of resin compounds, the following methods are recommended. (1) To a boiling solution of 1 lb. washing soda in 1 gal. water, 2 lb. powdered resin is added. Boiling is continued for 15 or 30 minutes or until the liquid becomes clear. The stock solution is diluted 10 times before use. (2) For preparation on a large scale, caustic soda is substituted for washing soda. Pure caustic soda, 30 parts, is dissolved in 900 parts of water, and to the heated solution is added 180 parts resin. Upon cooling the resin soap separates out as a yellow, pasty mass. The latter may be stored in this state, or dried at a temperature of 100° C. and reduced to powder. The dried soap is very soluble in water. The solution gives a wash of great adhesiveness. On exposure to air, combination with carbon dioxide takes place, resulting in the formation of sodium carbonate and resin. The compound is an excellent one for use against Aphids and other small insects which are not protected by hairs or wax. For Aphids, a strength of 1 lb. of resin in from 8 to 12 gals. wash is sufficient; for scale-insects 1 lb. to 5 or 6 gals. should be used. The ant, *Oecophylla smaragdina*, which is often associated with the attacks of green scale (*Coccus viridis*) on coffee, may be greatly reduced in numbers by spraying thoroughly during dull weather or in the morning or evening. Scale-insects should be treated in the early nymphal stage. The compound can be mixed with lead arsenate or Paris green and adds to the adhesiveness of these materials. (3) Resin and fish-oil soap is prepared by adding ½ pt. fish-oil to a boiling solution of ½ lb. caustic soda, 1 gal. water and 3 lb. resin. This wash can be used against the above insects as well as against wax scales and mealy bugs.

The standard formula for the preparation of kerosene emulsion is: ½ lb. soap, 1 gal. water, 2 gals. kerosene. For use in Malaya, the wash should be diluted until it contains from 5 to 8 per cent. of kerosene. A simple method for the preparation of small quantities of emulsion consists of mixing together by hand, 1 lb. soap with as much kerosene as will be absorbed by the soap, and diluting with 20 to 25 parts water for each part of kerosene used. Crude oil emulsion, as obtained commercially, contains 80 per cent. crude oil and 20 per cent. whale-oil soap. It is diluted with from 45 to 90 volumes of water before use. Two applications are necessary against Aphids, mealy bugs, and thrips. Sanitary fluids, consisting of creosote oil, phenol, or cresol emulsion, can be used against Aphids, soft scale-insects and mealy bugs, at a strength of 1 part to 100 parts water.

Locust destruction.—*Div. Entom., Dept. Agric., Union S. Africa, Pretoria*, Bull. no. 75, 1915, 8 pp. [Received 15th December, 1915].

The locust law of the Union of S. Africa provides that whenever locusts deposit their eggs, or hoppers appear upon any land, the occupier must immediately notify the nearest Government official. The occupier is also required to destroy the hoppers immediately, and he is forbidden to drive them from his land on to that of a neighbour, unless his growing crops are threatened; even then they must be destroyed if possible, and on no account may the growing crops of the neighbour be endangered. Materials for control are supplied free

by the authorities. Directions are given upon the drums for diluting and using the poison concentrate, which is poisonous to all plants. It may be used as a spray or as a bait. Other methods of locust destruction, such as the use of paraffin oil and dips, burning, trampling, beating, screens and trenches and trapping, are briefly outlined.

THOMPSON (R. L.). **Sunheat v. Weevils.**—*Rhodesia Agric. Jl., Salisbury*, xii, no. 5, October 1915, pp. 653-656.

The importance of *Calandra oryzae* (rice weevil) as a pest of maize, wheat, rice, etc., may be estimated from the fact that in a recent count 1 lb. of infested wheat contained 561 *Calandra*, but only 39 specimens of other species of grain-eating beetles. The usual remedy by fumigation with carbon bisulphide has certain disadvantages, such as the local price of material and the fact that as the eggs are resistant, so that several fumigations may be necessary. An alternative method is the employment of heat. Recent investigations in America have shown that the weevils cannot stand a temperature of 119° F. for more than two or three minutes. Observations were made by the author during April 1915, relative to the effect of the sun on the rice weevils. Infested grains were spread out in a single layer on sail-cloth heated by the sun to 115° or 116° F., for periods up to two hours. The grains were sealed in glass tubes and examined five months later. In many cases no weevils were found.

BALLARD (E.). **Mango-Hopper Control Experiments.**—*Agric. Jl., India, Calcutta*, x, no. 4, October 1915, pp. 395-398, 1 table.

Experiments in the control of the Jassid, *Idiocerus niveosparsus* (mango-hopper) were carried out in 1913 and again in December 1914. In the second instance, at Varagambady, 55 trees were selected for experiment. When badly attacked, the trees are covered with a sticky secretion, the flower-shoots blacken and wither and no fruit is set. A severe attack causes the total loss of the crop and greatly diminishes the vitality of the trees. The eggs are laid in slits made in the young leaves and flower-shoots. The young hoppers, upon emerging, feed at once on the leaf or flower-shoot. The latter either becomes incapable of producing fully formed fruit or dries up completely. As the adults are very active and are unharmed by sprays, it was decided to spray directly the young shoots were formed so as to kill the nymphs. Crude oil emulsion was used at the rate of 1 lb. to 10 gals. water. Spraying was performed every 10 days at first and later every 8 days from December to the end of March. Towards the end of this period, fish-oil soap was substituted for crude oil emulsion and proved of greater value. The cost of spraying averaged about 8*d*. a tree. The number of fruits from the sprayed trees was 2,044, compared with 642 from unsprayed trees. There is thus little doubt that spraying is profitable.

RAO (Y. R.). ***Helopeltis antonii* as a Pest of Nim Trees.**—*Agric. Jl. of India, Calcutta*, x, no. 4, October 1915, pp, 412-416.

Melia azadirachta (nim tree) in Coimbatore is frequently attacked by the Capsid bug, *Helopeltis antonii*. Injury occurs especially from December to February, when the attacked twigs wither. In a severe

case a whole branch may be killed. The eggs of the bug are placed in punctures in young twigs. Usually two are found together; about 50 eggs are laid by a single female under natural conditions. Eggs deposited on 6th April 1915 took six days to hatch. The young nymph sucks the sap from the shoot, and where the proboscis pierces the bark, the young tissues in the neighbourhood are killed and a discoloured patch formed. A poisonous secretion is probably injected into the tissues through the proboscis, since the damage done to the shoots is out of proportion either to the size of the bugs or to their numbers. At Coimbatore, mahogany and guava are also attacked to a slight extent. In Ceylon, this insect has been recorded on tea, cacao and chinchona. The leaves of nim trees are shed at the beginning of March and the new shoots in April are attacked by a second generation of bugs. No further injury occurs until October.

As a remedial measure, spraying with a contact poison is useful against the nymphs attacking small trees. The spray should be applied as soon as the first cases of wilt are noticed. In the case of large trees, the cost of spraying would render the treatment prohibitive.

RUTHERFORD (A.). **Notes on Ceylon Coccidae.**—*Spolia Zeylanica, Colombo,* x, no. 37, October 1915, pp. 103–115.

The following species of COCCIDAE are recorded:—*Ischnaspis longirostris*, Sign., on *Graptophyllum hortensis*; *Frogattiella penicillata*, Gr.; *Chrysomphalus cistuloides*, Gr.; *Chionaspis* (?) *subcorticalis*, Gr., under the bark of *Artocarpus integrifolia*; *Aspidiotus* (?) *cuculus*, Gr., on twigs of *Mesua ferrea*; *Parlatoria pergandii*, var. *phyllanthi*, Gr., on *Diospyros ebenum*; *Diaspis boisduvalii*, Sign., on an orchid; *Aspidiotus* (?) *orientalis*, Newst., on leaves of *Limonia alata*; *Chrysomphalus rossi*, Mask., on *Cycas* sp.; *Chrysomphalus aurantii*, Mask., on *Morus* sp.; *Pseudaonidia trilobitiformis*, Gr., on *Peddeia africana*; *Aonidia perplexa*, Gr.; *Antonina* sp.; *Morganella maskelli*, Ckll., on *Morus* sp., *Cinnamonium zeylanica* and *Brousonettia papyrifera*; *Aulacaspis barberi*, Gr., on *Loranthus* sp.; *Eriococcus* (?) *araucariae* Mask., on *Araucaria cookii*; *Aspidiotus hederae*, Vall., on *Artocarpus integrifolia*; *Protopulvinaria longivalvata*, Gr., on *Gardenia latifolia*; *Pseudoparlatoria parlatorioides*, Comst., on guava; *Chionaspis simplex*, Gr., under the leaf-sheaths of bamboo; *C. herbae*, Gr., on *Panicum* sp.; and *Fiorinia fioriniae*, Targ., on *Cupressus* sp., *Turpinia* sp., *Walsura piscidia*, and *Eugenia* sp.

HEADLEE (T. J.). **Report of the Entomologist.**—*Rept. Entom. Dept., New Jersey Agric. Coll. Expt. Sta., for 1914, Paterson,* 1915, pp. 339–360.

Typhlocyba comes, Say (grape leaf-hopper) was abundant in the southern parts of the State during August and September 1915. *Psylla pyricola*, Forst. (pear psylla) was present in various localities. The hibernation of this insect may be prevented by scraping all rough bark from the trunks and larger branches. During warm periods in November and December, adults which emerge from shelter may be destroyed by a nicotine spray. In badly infested orchards, autumn spraying, delayed winter spraying with lime-sulphur and again when

the blossoms fall, are recommended. *Aphis pomi* (*mali*) and *Eriosoma* (*Schizoneura*) *lanigerum* were abundant. *Lepidosaphes ulmi* (oyster-shell scale) appeared in increasing numbers and was abundant on birch, poplar and walnut. *Lygidea mendax*, Reut. (false apple red-bug) occurred in various orchards in New Brunswick. *Epitrix cucumeris*, Harr. (potato flea-beetle) was the most serious pest of the year, attacking both first and second crops of potatoes. Other injurious insects recorded were:—The Scarabaeid, *Macrodactylus subspinosus*, F. (rose-bug), May beetles, *Anthonomus signatus*, Say (strawberry weevil), *Pissodes strobi*, Peck (white pine weevil), *Scolytus quadrispinosus*, Say (hickory bark beetle), the weevil, *Eucactophagus graphipterus*, Champion, *Cirphis* (*Leucania*) *unipuncta*, Haw. (army worm), *Malacosoma americana*, F. (apple-tree tent caterpillar), *Eriopus floridensis*, Guen. (Florida fern caterpillar), *Iridomyrmex humilis*, Mayr (Argentine ant), the Cecidomyid, *Lasioptera vitis* and the Syrphid, *Merodon equestris*, L. (narcissus fly).

Experiments against the peach borer [*Aegeria exitiosa*] showed that soft asphaltum gave the best results, because it withstood the weather for a complete season and allowed borers to penetrate only below its lower edge. Observations on combining nicotine with ordinary spraying mixtures showed that nicotine preparations can be added to lead arsenate, Bordeaux mixture, etc., without the formation of a serious precipitate and without any apparent detriment to the nicotine. Work on potato spraying and dusting against *Epitrix cucumeris* was continued during the year.

LOYER (N.). **Boîte à raisin.** [A protective cover for growing grapes.] —*Bull. Soc. Nat. Acclimat., Paris*, lxii, no. 8, August 1915, pp. 250–253, 3 figs.

Instead of paper bags, M. Debreuil has for the past 20 years used a cylindrical box of wire gauze for the purpose of protecting growing grapes. The construction of these cages is described. Each cage costs about $2\frac{1}{2}d.$, and besides being lasting, it favours the perfect ripening of the fruit far better than a paper bag. A wire fastened to one of the wooden strips which form the opening of the box, enables the cage to be suspended so as not to press on the grapes.

d'HÉRELLE (M. F.). **Sur le Procédé biologique de Destruction des Sauterelles.** [The biological method for the destruction of Locusts.] —*C. R. hebdom. Acad. Sci., Paris*, clxi, no. 17, 26th October 1915, pp. 503–505.

The control of locusts and grasshoppers by means of *Coccobacillus acridiorum* has been successful in Mexico in 1910 and in Tunis in 1915. The virulence of the *Coccobacillus* decreases rapidly in cultures and the use of a virus insufficiently exalted may give results which are opposed to those desired. The exaltation of the virulence may be produced by passage through a series of locusts. In *Schistocerca*, in which incubation only lasts a month, this can be done by using adults which have just deposited eggs and the inoculation of young forms can be effected at the time of hatching. In *Dociostaurus* (*Stauronotus*), in which incubation lasts 8 or 9 months, adults cannot be used, and the young

hoppers must have attained a certain size before beginning laboratory operations. During the summer of 1915, an epizootic destroyed in a few hours a swarm of young hoppers near Sidi-Bou-Baker in Tunis. Infestation had been carried out 3 weeks before, about 20 kilometres further south. To determine whether this epizootic had been brought about by the passage of infested swarms, dead individuals were collected, pulverised in water, and the latter injected into healthy insects. Although the dead insects had been exposed to the sun for five days before collection, the death of inoculated insects occurred in four hours. Further experiments with the bodies of locusts preserved in a sealed tube for two years showed that the *Coccobacillus* was virulent and caused the death of healthy insects in six hours. The above results suggest that the following method of procedure is advisable. Beginning with a culture of *C. acridiorum*, passages through a series of locusts is effected, until a virulence is reached by which death ensues in eight hours. The bodies of such locusts are dried in a desiccator over sulphuric acid, then reduced to powder and sealed in glass tubes. Under these conditions, the virus should keep without alteration for two years. When required for use, the powder is mixed with a few drops of water or sterile broth and the bacillus isolated on gelatine. The colonies are sufficiently developed in 18 hours for use in inoculating locusts. The most suitable medium consists of 5 gr. peptone, 5 gr. meat extract, 5 gr. salt and 1 litre of water. The culture should be kept at the temperature of the air.

SCHABLOWSKI (H.). **Der Koloradokäfer** (*Leptinotarsa decemlineata*, **Say**)**: Sein Auftreten in der Feldmark Stade 1914.** [The Colorado beetle, *Leptinotarsa decemlineata*, Say, and its appearance in the Stade district in 1914.]—*Zeitschr. für Pflanzenkrankheiten, Stuttgart*, xxv, no. 4, 17th July 1915, pp. 193-203, 1 fig. 3 plates.

This paper deals with the outbreak of *Leptinotarsa decemlineata*, Say (Colorado beetle), in Germany in 1914, which has already been recorded [see this *Review*, vol. ii, p. 711; iii, p. 712].

DALMASSO (G.). *Diaspis e Prospaltella.* [*Aulacaspis pentagona* and *Prospaltella berlesei.*]—*Riv. Vitic. Enol. Agrar., Conegliano*, xxi, no. 21, 1st November 1915, pp. 487-490.

In Venetia, the Coccid, *Aulacaspis pentagona*, has been practically stamped out. According to Grassi, this result is largely due to an infectious disease and attention is drawn to the fact that even before the introduction of *Prospaltella berlesei*, this pest, in certain years and localities diminished very greatly in numbers. According to Berlese, the decrease in the number of scales was due to the withering of branches infested by them. The author believes, however, that the existence of an infectious disease is possible.

LUNDEN (O.). **Borax, ett medel till utrotande af fluger och insektlarver, särskildt sädesknäpparens larver i trädgårdsodlingen.** [Borax, a remedy against flies and insect larvae, especially wireworms in the garden.]—*Finska Trädgårdsodlaren, Helsingfors*, ix, no. 7, July 1915. [Received 1st November 1915.]

The author summarises the experiments with borax against the larvae of the house-fly in the United States and recommends the use of a 1 per cent. solution against wireworms on strawberries.

SCIARRA (G.). **Contribuzione alla Conoscenza della** *Carpocapsa pomonella*, **L.** [Contribution to our knowledge of *Cydia* (*Carpocapsa*) *pomonella*, L.]—Reprint from *Boll. Lab. Zool. Agrar., R. Scuola Sup. Agric., Portici*, x, 30th June 1915, pp. 33-50, 1 fig. [Received 5th November 1915.]

This paper gives an account of the bionomics of *C. pomonella* and the damage done by the larvae. All fallen fruits except those blown down by wind are said to have been attacked by this pest; the results of the examination of 800 apples, which bear out this statement, are given. Flacherie is stated to cause great mortality among the first generation of larvae, especially in the insectary; the disease known as "calcino," which kills large numbers of silkworms, is the cause of even more deaths. The following parasites were actually observed by the author: Hymenoptera: The Ichneumonids, *Hemiteles inimicus*, Grav., *Pimpla roborator*, F., *Trichomma enecator*, Rossi, *Caenocryptus vittatorius*, Jur., *Pristomerus vulnerator*, Panz., *Phygadeuon variicornis*, Thoms.; the Braconids, *Ascogaster quadridentatus*, Wesm., *Ascogaster rufipes*, Lat., *Microdus conspicuus*, Wesm., and the Chalcids, *Dibrachys boucheanus*, Ratz., and *Perilampus laevifrons*, Dalm. Diptera: the Tachinid, *Leskia aurea*, Fall. The following have been recorded by other observers:—Hymenoptera: The Ichneumonids, *Campoplex pomorum*, Ratz., *Pimpla annulipes*, Brullé, *Stylocryptus brevis*, Grav., and *Pristomerus vulnerator*, Panz.; the Braconid, *Heterogamus* (*Macrocentrus*) *delicatus*, Cress.; the Chalcids, *Entedon leptoneurus*, Ratz., *Eulophus bulmeringii*, Ratz., *Perilampus laevifrons*, Dalm., and the Proctotrupid, *Inostemma boscii*, Latr. Diptera: the Tachinid, *Actia pomonellae*, Schnabl & Mokrz. From 130 larvae of *Cydia* collected in 1912, 25 adults were reared and 31 parasites, the remainder dying from fungus diseases. For purposes of comparison with these laboratory results, 27 trees loaded with fruit were banded just below the fork on 24th July 1912; the belts were examined on 31st July and 1st and 2nd August and yielded 381 larvae and 106 pupae of *Cydia* and 13 adults of *Dibrachys boucheanus*. Unfortunately the bulk of the larvae and pupae were killed by fungus disease but 11 imagines of *Cydia* and 77 parasites were reared of which 65 were *D. boucheanus*. In the following year 74 larvae and 26 pupae of the second generation yielded 22 adult *Cydia*, 222 *D. boucheanus*, and 5 *Ascogaster rufipes*. Experimental proof was obtained that the *Dibrachys* is a true parasite of *Cydia* and not a hyperparasite, a single pupa of *Cydia* placed in a tube with a male and female *Dibrachys* yielding 34 adult parasites after 25 days.

As spraying with arsenicals cannot be practised against the larvae of the second generation, it is suggested that the collection of the larvae of the first should be carried out in such a manner as to ensure the rearing and liberation of the largest possible number of parasites. The bulk of the larvae were found near the base of the trees and generally on the side of the trunk facing the south-west. The cost of hand collection of the larvae being prohibitive, banding with sacking below the main fork and also below each secondary fork is suggested. The larvae so collected should be put into boxes the top of which are covered with wire gauze, the mesh of which must not be more than 2 mm. This permits all the parasites excepting the two Tachinids, *L. aurea* and *A. pomonellae* to escape. In order to catch the larvae of the first

generation, the sacking bands should be in position before the end of July and never later than 2nd August, and a fresh lot of bands must be ready to put on before the middle of September in order to catch those of the second generation. At the end of September all the boxes may be thoroughly cleaned and made ready to receive the bands which should be taken down towards the end of October. The boxes with the bands in them are kept covered and taken into the orchards about the middle of March when the parasites are beginning to emerge; the adults of *Cydia* emerge a little later than the parasites. By this method, systematically carried out by all growers in an orchard area, and the regular and almost daily collection and burial of all fallen fruit, it is believed that *Cydia* may be controlled and the orchard yield very greatly increased.

SARRA (R.). **Osservazioni biologiche sull' *Anarsia lineatella*, Z., dannosa al frutto del mandorlo.** [Biological observations on *Anarsia lineatella*, Z., injurious to the almond.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, x, 6th July 1915, pp. 51-65, 3 figs. [Received 5th November 1915.]

Anarsia lineatella, Z. [peach twig-borer] has two generations in Italy, the first appearing late in May, in June and in July, and the second, early in September and in October. The average time required for development from egg to adult is about 60 days. Besides almonds, it attacks prunes, plums, apricots and peaches, and has also been recorded in apples. In the second half of March and early in April, the young almonds are attacked by the larvae of the first generation, hatched from eggs deposited in the preceding autumn by second generation adults. The larvae of the second generation hatch from eggs deposited in June and July and feed on the soft part of the fruit; they are less destructive to almonds than the first generation. Among the natural enemies of this pest are two Chalcids, *Encyrtus variicornis*, Nees, and *Elasmus flabellatus*, Fonsc. At Matera, two generations of *E. variicornis* were observed; the adults of the first appeared from 30th May to 22nd July and those of the second, from 6th September to 9th October. On an average, 28 parasites hatch from one egg; these are either all males or all females. Of 357 larvae of *A. lineatella* examined in 1912, 1913 and 1914, about 33 per cent. were parasitised by *E. variicornis*. The Proctotrupid, *Parasierola gallicola*, Kieffer, is, next to *E. variicornis*, the most efficient parasite of *A. lineatella*. There is one generation annually, which attacks the second generation of the host, the first adults appearing at the beginning of September. The Braconid, *Apanteles xanthostigma*, Hal., is another parasite of *A. lineatella*. This has two generations annually; in 1913, the first appeared from 26th May to 1st June and the second from 28th August to 20th September.

Natural control methods are recommended against *A. lineatella*. Almond trees should not be planted in very stony ground or such as is enclosed by pastures, walls, hedges, etc. When husking the almonds, the chrysalids and larvae of the moth should be collected, together with the cocoons of the parasites. The chrysalids must be destroyed,

but the larvae of the moth and the cocoons of the parasites should be kept in boxes closed with a net sufficiently fine to imprison the moth but not its parasites. All punctured fruit should also be collected and placed in these boxes. Light traps are also useful against the moths.

MOLINA (E.). **Nuevo método para combatir toda clase de cochinilla y otros insectos.** [A new method for combating all kinds of Coccids and other insects.]—*Bol. Minist. Agric., Buenos Aires*, xviii, nos. 1–2, July-August 1914, pp. 102–104. [Received 5th November 1915.]

A preparation consisting of lysol, 2½ pints; cyanide of potassium, 3 oz.; black soap, 3 lb.; tepid water, 20 gals., proved very efficient against scales on citrus trees, but did not come generally into use owing to the high cost of the first two ingredients. Subsequently the following formula was found to yield exceedingly good results against citrus scales such as *Chrysomphalus aonidum*, *Lepidosaphes beckii* (*Mytilaspis citricola*) and *Coccus* (*Lecanium*) *hesperidum*, which congregate on the foliage or other smooth surfaces: Wheat flour, 60 lb.; kerosene, 3 gals.; water, 97 gals. This mixture was modified as follows, in order to control *Aulacaspis pentagona* and other Coccids which are usually found on the trunk, branches and similar rough surfaces: wheat flour, 20 lb.; kerosene, 1 gal.; water, 19 gals. To control sucking insects unprotected by shields, such as *Pseudococcus* (*Dactylopius*) *vitis*, the following should be used: Wheat flour, 30 lb.; kerosene, 4 gals.; water, 96 gals. For preparing all the above, the method is exceedingly simple: Half the quantity of water is boiled in a container of sufficient capacity, the flour, dissolved in the remaining cold water, is added and stirring is continued until the mixture has been thoroughly boiled. It is then passed through a fine sieve and the kerosene is added. The solution must be used warm and a sunny day must be chosen for the operation. Any sprayer may be used provided it has sufficient pressure to deliver a very finely divided spray.

BARROETAVEÑA (F. A.) & GIROLA (C. D.). **Extracto de los trabajos efectuados por la comisión nacional designada por el Ministerio de Agricultura para propagar la *Prospaltella* (*Prospaltella berlesei*, How.) como medio de destruir la *Diaspis* (*Diaspis pentagona*, Targ.), durante los diez primeros meses de ejercicio, desde Junio 1914 a Abril 1915.** [An abstract of the work done by the National Commission nominated by the Ministry of Agriculture to establish *Prospaltella berlesei*, as a means of destroying *Aulacaspis pentagona*, during the first ten months of working, from June 1914 to April 1915.]—*Bol. Minist. Agric., Buenos Aires*, xix, nos. 5–6–7, May-June-July 1915, pp. 394–415, 1 col. plate. [Received 5th November 1915.]

From June to November 1914, 1½ million twigs parasitised by *Prospaltella berlesei* were distributed to 5,255 fruit-growers in Argentina. The parasite was established in the greater part of the area infested

by *Aulacaspis pentagona*, but it is as yet too early to announce the results. The work cost only a fraction of the expense of inspecting scale-infestation or of attempting to control it with insecticides. In the latter portion of these reports it is stated that all indications point to the success of this natural control.

Taches noires du poirier. [Black spot of the pear.]—*Jl. d'Agric. Pratique, Paris*, xxviii, no. 60, 18th November 1915, p. 622.

Concentric black spots on the leaves of the pear and apple are caused by the larvae of the Microlepidopteron, *Leucoptera* (*Cemiostoma*) *scitella*, which live in the leaf. On attaining their full growth they take refuge under the bark or in crevices on the trunk and there spin a cocoon from which the adult emerges from April to June. Infested leaves should be gathered and burnt, while the trunk and large branches should be painted with a milk of lime of 20 per cent. strength to which 5 per cent. of copper sulphate has been added.

Ожидаемый урожай хлопка въ 1915 году. [The expected harvest of cotton in 1915.]—**«Извѣстія Главнаго Управленія З. и З.»** [*Bulletins of the Central Board of Land Administration and Agriculture*], *Petrograd*, no. 41, 24th October 1915, pp. 1008–1011.

The information gathered by the Department of Agriculture on the state of the cotton crops in Turkestan up to the 14th September 1915, shows that little damage had been done by insect pests. In Transcaspia locusts appeared in small numbers on irrigated fields, while in Samarkand, slight outbreaks of *Tetranychus telarius* and *Euxoa segetum* were recorded. In Ferghana, *T. telarius* did serious damage in some cases; the cotton Aphid [*Aphis gossypii*] was also present.

ANDREIEV (I.). **О борьбѣ съ майскимъ жукомъ.** [On the control of Cockchafers.]—**«Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, 1915, nos. 6–7, pp. 1032–1039.

This is a short report on the campaign against *Melolontha* in the Muran pine forests in Simbirsk in 1913 and 1914. This forest, which has an area of some 12,700 acres, has of late years been heavily infested with *Melolontha hippocastani*, so much so that it was practically impossible to renew the plantations of pines, especially on old clearings overgrown with thick grass. Control measures consist of picking out the larvae during felling or weeding and in collecting the imagines and destroying them by boiling water, and afterwards either burying them in the soil as a manure or using them as food for pigs. In 1914, which was a year in which the adults were numerous, they appeared on the 2nd May and during that month about five millions of females were collected and destroyed at a cost of about £200 over an area of 4,050 acres. It is proposed in the future to turn as many pigs as possible into the forests.

SIMON (Th. P.). *Hylobius abietis* **и мѣры борьбы съ нимъ, по наблюденіямъ 1913-14 гг. въ Орловской г.** [*Hylobius abietis* and remedies against it, according to observations in the govt. of Orel in 1913-14.]—**«Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, 1915, nos. 6-7, pp. 1080-1085.

The usual remedy recommended for the control of *Hylobius abietis*, viz., the grubbing of the clearings, although useful in many respects, is expensive and only effective if applied the next winter after the clearings are made. The author's observations have satisfied him that the barking of the stumps is more satisfactory; over 10,000 larvae were collected from 492 stumps, which had not been barked, while in a neighbouring plot, containing 481 stumps, of which all but 98 had been barked the winter before, only 1,239 larvae were found and these only in the unbarked stumps. The barking of pines round the base before felling is therefore advocated. Clearings should not be replanted for three years.

FOLMER (Iv.). **Трипсъ яровой пшеницы и мѣры борьбы съ нимъ.** [Thrips of spring-sown wheat and its control.]—**«Земледѣлецъ.»** [*The Agriculturist*], *Petrograd*, xx, no. 9, September 1915, pp. 396-398.

Remedies given for thrips in winter-sown wheat, include the burning of the stubbles, in which, as well as in the soil, the larvae winter. The early scarifying of the soil, thus increasing the amount of moisture, favours the development of the disease caused by the fungus, *Botrytis bassiana*. The early sowing of summer wheat, preferably on clay and black soil, on which potatoes, beetroots, carrots, sunflowers or maize have been previously grown, is also advised.

TROITZKY (D.). **Изслѣдованіе швейнфуртской зелени.** [Analysis of Paris Green.]—**«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 31, 14th August 1915, pp. 870-871. [Received 8th November 1915.]

The author calls attention to adulterations of Paris green, which are facilitated in many cases by the methods of analysis usually adopted. Paris green being a double copper salt of acetic and arsenious acid, the analysis must prove the presence both of about from 55 to 61 per cent. of arsenious anhydride and of from 27 to 31 per cent. of copper oxide; the amount of free arsenic should not exceed about 2 per cent.

Курсы по микологіи, фитопатологіи и прикладной энтомологіи. [Courses on mycology, phytopathology and applied entomology.] **«Земледѣльческая Газета.»** [*Agricultural Gazette*], *Petrograd*, no. 35, 11th September 1915, p. 987.

It is announced that, as in previous years, the courses of lectures on phytopathology, mycology and applied entomology will be held in 1916 at Petrograd at the Bureau of Mycology and Phytopathology for agricultural instructors.

GUZHAVIN (T. A.). **Садъ—мое богатство.** [Orchard—my wealth.]—Supplement to **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture & Market-Gardening*], *Petrograd*, 1915, 2 vols., 247 pp., 136 figs.

A special chapter of this book deals with insect pests and remedies for them, a short life-history, etc., being given of the following insects injurious to orchards:—*Aporia crataegi*, *Lymantria dispar*, *Euproctis chrysorrhoea*, *Malacosoma neustria*, *Cheimatobia brumata*, *Cydia pomonella*, *Hyponomeuta malinellus*, *Anthonomus pomorum*, *Psylla mali* and *Aphis pomi*. *Melolontha* is dealt with as a pest of strawberries; *Bembecia hylaeiformis* and *Byturus tomentosus*, as pests of raspberries; *Incurvaria capitella*, *Aphis ribis* and *Aegeria* sp., as pests of currants; *Abraxas grossulariata* and *Pteronus ribesii*, as pests of gooseberries. Particulars of insecticides, sprayers and instructions as to spraying are also given.

BORODIN (Dm.). **Борьба съ зимней пяденицей и пяденицей обдирало.** [The control of *Cheimatobia brumata* and *Hibernia defoliaria*.]—**«Хуторянинъ.»** [*Chutorianin*], *Poltava*, nos. 40-41, 24th October 1915, pp. 852-856, 6 figs.

Outbreaks of *Cheimatobia brumata* occurred during the summer of 1915 in many districts of Poltava and in some of the neighbouring governments. The life-history of this pest and the damage done by it are shortly dealt with, as well as that of *Hibernia defoliaria*, which was also present. The following remedies are recommended:—Spraying with djipsin, 1 lb. in from 40 to 48 gals. water, 4 pints of molasses being added to render it adhesive, or Paris green (½ lb. of green and 1½ lb. of unslaked lime in from 55 to 60 gals. water) early in spring before the buds open; digging the soil beneath the injured trees at the end of May, when pupation is taking place; the use of sticky belts.

BORODIN (D.). **Хлѣбный пильщикъ на западномъ опытномъ полѣ Ставрополь-Кавказской с.-х. опытной станціи.** [*Cephus pygmaeus*, L., on the western experimental field of the Agricultural Experimental Station of Stavropol, Caucasus.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, nos. 33-34-35-36, 1915, pp. 876-883.

The results of the examination of a large number of samples of the stubble of barley and winter and spring sown wheat in the autumn of 1913 are recorded. The sawflies reared in the following spring showed a great prevalence of *Cephus pygmaeus*, L., only a small minority being *Trachelus tabidus*, F. About 5 per cent. of these pests were infested by the Ichneumon, *Collyria calcitrator*, Grav., and the Chalcid, *Arthrolysis* (*Picroscytus*) *scabricula*, Nees. The author gives a number of tables which can be summarised as follows:—(1) Barley showed a comparatively low infestation, all the various sorts being attacked in nearly the same degree. (2) Thinly sown barley was more infested; this may be due to the greater thickness and development of the stems, and this is in accordance with the statements of Lokot and Kurdjumov that these pests mainly attack strong and well developed plants.

(3) Spring-sown wheat was considerably more infested than barley, the "Chludovsk" variety showing the greatest, and the local variety the least infestation. (4) Amongst winter-sown wheats, the loca variety also suffered less; and the better developed plants were more attacked.

BRIZOVSKY (A.). **Яблоневая медяница и ея уничтоженіе.** [*Psylla mali* and its destruction.]—**«Наше Хозяйство.»** [*Our Husbandry*], *Eletz*, no. 13, 28th July 1915, pp. 12–16, 7 figs. [Received 12th November 1915.]

The various stages of *Psylla mali* are figured and described. The larvae live only on apple and pear trees, whereas the adults are found on many other trees, such as plums, apricots and cherries, on which, however, they have not been observed to oviposit. The eggs hibernate and the larvae appear in the spring and attack the buds; as they hatch before the buds have unfolded, they are compelled to pass two or three days on the surface of them and this opportunity for carrying out spraying operations should not be missed.

ZVIEREZOMB-ZUBKOVSKY (E.). **Амбарный долгоносикъ и борьба съ нимъ.** [*Calandra granaria*, L., and its control.] Published by the Kiev Entomological Station of the South-Russian Agricultural Syndicate. *Kiev*, 1915, 9 pp., 8 figs.

This is a pamphlet giving the usual information on the life-history of *Calandra granaria*, L., and the remedies for it.

JAKOVLEV (L. N.). **Кобылка въ Змѣиногорскомъ уѣздѣ Томской губерніи и методы борьбы съ ней.** [Locusts in the Zmeinogorsk district of the govt. of Tomsk and methods of their control.] —**«Сибирское Сельское Хозяйство.»** [*Agriculture of Siberia*], *Tomsk*, nos. 17 and 18, September, 1915, pp. 532-535 and 564–566.

Locusts during the last 20 or 30 years have appeared yearly in Eastern European Russia and in Siberia. Serious outbreaks are connected with dry years, and if the autumn of a dry year be also dry, there is every reason to expect a large outbreak in the following year. In 1915, they were present in large numbers in parts of the government of Tomsk. Starlings were observed to destroy much larger numbers than rooks, ravens, honey-buzzards and other birds, which only pick up as many as they can eat. Gulls were also very useful in destroying them. The author gives a list of the species found during the summer, using their Russian names, which probably represent the following:—*Gomphocerus sibiricus*, L.; *Bryodema tuberculata*, F.; *Stenobothrus morio*, L.; *Tmethis muricata*, Pall.; *Stethophyma fuscum*, Pall.; and *Arcyptera flavicosta*, Fisch. Some 7,700 acres of crops were destroyed in the district. The author is of opinion that a large outbreak of locusts may be expected again next year and urges the necessity of organising a systematic campaign against them.

Какъ организовать борьбу съ вредителями сельскаго хозяйства вообще и виноградарства въ частности. [How to organise the control of pests of Agriculture generally and of Viticulture in particular.]—**«Вѣстникъ Виноделія.»** [*Herald of Viticulture*], *Odessa*, nos. 9 and 10, September-October 1915, pp. 419-423.

These are two circular letters issued by the Department of Agriculture. The first of them, referring to the difficulties which are bound to be experienced in obtaining the usual insecticides from abroad, suggests the use of a lime-sulphur mixture instead of copper sulphate, and sodium arsenite and djipsin instead of Paris green. The second circular deals with the purchase of foreign manufactured insecticides by various Zemstvos and Agricultural Organisations through the Department of Agriculture. The maximum prices fixed are:—£1 1*s*. 0*d*. per pood (36 lb.) for copper sulphate; £2 2*s*. 0*d*. per pood for Paris green; 10*s*. 6*d*. per pood for flowers of sulphur; and 27*s*. 6*d*. per pood for formalin.

Главнѣйшіе запросы, поступившіе въ Центральную Фитопоатологическую Станцію за 1914 годъ. [The principal queries received at the Central Phytopathological Station during 1914.]—**«Болѣзни Растеній.»** [*Diseases of Plants*], *Petrograd*, ix, nos. 1-2, 1915, pp. 44-66.

A number of queries referring to insect pests are given, with the remedies suggested in reply. They include:—White acacia (*Robinia pseudacacia*), young shoots infested with *Eulecanium* (*Lecanium*) *corni, Bché.*; *spraying with kerosene emulsion. Water melons*, melons and cucumbers attacked by *Tetranychus telarius*, L.; the burning of the heavily infested plants, while those which are less infested should be powdered with flowers of sulphur or sprayed with a solution of 1 lb. of wheat flour in about 9 gallons of water. Medlar trees infested with *Aphis crataegi*, Kalt.; spraying with a solution of soft soap. Pear trees infested with *Hoplocampa brevis*, Klug; spraying the buds with a solution of 2 lb. of soft soap, ½ lb. of crude carbolic acid, and 6 lb. of tobacco extract in from 40 to 45 gallons of water, or with a solution of 2 parts of clay and 1 part of lime. Against *Byctiscus betulae* (*Rhynchites betuleti*) spraying early in spring with milk of lime (4 lb. of freshly slaked lime in about 3 gallons of water). Leaves of oak (*Quercus mongolica*) injured by *Phylloxera coccinea*, Heyden; spraying with quassia solution. Branches of firs were injured by *Eucosma* (*Grapholitha*) *tedella*, Cl., the caterpillars of which eat into the needles; they hibernate in the soil and pupate next spring, the adult being on the wing in June, July and August; no practical remedies exist. Willows were injured by *Aphis amenticola*, Kalt., *Eriophyes triradiatus*, Nal., *E. salicis*, Nal., *Phyllocoptes parvus*, Nal., *P. magnirostris*, Nal., and *Epitrimerus salicobius*, Nal. Leaves of iris injured by the Chrysomelid, *Aphthona nonstriata*, Goeze; spraying with Paris green. Young shoots of roses injured by *Hylotoma rosae*, L.; destruction of infested shoots, collection of larvae and spraying with Paris green or 2 per cent. barium chloride. Plums injured by larvae of *Hoplocampa fulvicornis*, Klug; the destruction of damaged and fallen fruits. Pine plantations, 3–6 years old, injured

by *Hylobius abietis*, L.; trap trenches round the plantations, which should not be renewed for two or three years after cutting; grubbing the stumps; trap-logs and smearing the young trees with some adhesive substance for two-thirds of their height. Fig trees attacked by *Rhopalosiphum dianthi*, Schr.; washing the diseased plants with a solution of 1 lb. of soap in 3 gallons of water, or spraying with a solution of 1 lb. of tobacco extract in 3–4½ gallons of water.

COLLINGE (W. E.). **A preliminary report upon the economic status of the British species of woodpeckers and their relation to forestry.**—*Jl. Bd. Agric., London*, xxii, no. 8, November 1915, pp. 789–791.

The three woodpeckers of the British Isles, viz., *Dendrocopus major*, L. (great spotted woodpecker), *Dendrocopus minor*, L. (lesser spotted woodpecker) and *Gecinus viridis*, L. (green woodpecker) are dealt with in this preliminary report, the majority of the observations having been made on the last-named species. The stomach contents of 91 specimens were examined and fully 75 per cent. of the food was found to consist of injurious insects, the principal species being: *Cryptorrhynchus lapathi*, L. (osier weevil), *Hylobius abietis*, F. (pine weevil), various species of *Ips* (*Tomicus*), *Myelophilus piniperda*, L. (pine beetle), *Hylesinus fraxini*, Pz. (ash bark beetle), *Scolytus destructor*, Oliv. (elm bark beetle), *Hylastes ater*, Payk. (black pine beetle), the Longicorns, *Saperda populnea*, L. and *Rhagium bifasciatum*, F. *Sinodendron cylindricum*. F., *Xyleborus dispar*, F. (shot-borer beetle), the larvae of *Rhyacionia* (*Retinia*) *buoliana*, Schiff. (pine-shoot moth), *Aegeria* (*Sesia*) *culiciformis* (birch clearwing moth) and *Zeuzera pyrina*, L. (wood leopard moth) have also occurred. Of the remaining 25 per cent. of food, quite 20 per cent. consisted of ants. A careful investigation, extending over two years, has shown that of upwards of 100 trees attacked by these birds not a single one was previously sound. In one case more than 1,300 beetles were found in the stomach, in another, 1,100, and from 300 to 800 were common. Of the larvae of the larger timber-destroying beetles, the remains of 57 examples of *R. bifasciatum* were found in one bird. The stomach contents of two nestlings of *G. viridis* consisted entirely of beetle larvae. No definite conclusions could be drawn from the few examples of faeces of birds in the wild state, which were obtained with difficulty, but so far, only insect remains were discovered, and there was no evidence to support the view, held by some foresters, that woodpeckers disseminate the seeds of weeds. There is no doubt, as a result of these investigations, that woodpeckers are distinctly beneficial to British forestry.

Notice Regarding the Importation of Plants and Seeds into the Uganda Protectorate.—*Kampala*, 19th August 1915. [Received 27th November 1915.]

The following recapitulation of the regulations in force governing the importation of plants is published for general information. A "plant" includes growing plants, cuttings, buds, bulbs, seeds, roots, and fruits and vegetables intended for propagation. All plants imported must be fumigated by the Government Entomologist,

Kampala, subject to his discretion, and must be conveyed to, and removed from the place of fumigation by the importer. Importers should accordingly make arrangements, when necessary, with an agent for clearance through the Customs, delivery to and removal from the fumigation place. In the case of plants arriving by post, the Post Office Authorities, Kampala, deliver the parcel to the Government Entomologist, who, after treatment, will forward it to the addressee without extra postal charge. The only port of entry for plants is Port Bell and the only place of entry is Kampala. The importation of cotton seed, coffee plants and seed (other than roasted beans and ground coffee) or of plants from Ceylon is prohibited, without the written consent, previously obtained, of the Governor. No other restrictions are at present in force as regards the importation of other plants and no permission is needed for their importation.

RUHMAN (M.). **Insect Notes from the Okanagan in 1914.**—*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, July 1915, pp. 7–11. [Received 19th November 1915.]

The following insect pests occurred generally throughout the Okanagan Valley:—*Lygus pratensis* (tarnished plant-bug) on fruit buds; *Eriophyes pyri* (pear-leaf blister-mite) on pears; *Eriosoma lanigerum* (woolly aphis); *Aphis pomi* (*mali*) (green apple aphis); *Tetranychus bimaculatus* (red spider) on prunes; *Lepidosaphes ulmi* (oyster-shell scale) particularly prevalent in low-lying moist places on uncleared land; *Aphis brassicae* (cabbage aphis) on cabbage and turnip; *Pieris* (*Pontia*) *rapae* (cabbage-worm) common everywhere; *Schizura concinna* (red-humped apple worm); *Myzus cerasi* (black cherry aphis); *Myzus ribis* (currant aphis); *Epitrix subcrinata* on tomatoes and potatoes; *Hyloicus drupiferarum* (plum sphinx); *Cacoecia* (*Archips*) *cerasivorana* (cherry tree tortrix) on choke-berries; *Cacoecia* (*Archips*) *argyrospila* (fruit-tree leaf-roller); the Elaterids, *Corymbites inflatus* and *Cardiophorus fenestratus* on buds and leaves of young apple trees; *Chermes* on ornamental spruce trees; *Empoasca mali* (apple-leaf hopper); *Malacosoma pluvialis* (tent-caterpillar); *Eriocampoides limacina* (pear-slug); *Enarmonia prunivora* (lesser apple-worm); *Hyphantria cunea* (fall web-worm) on apples; *Otiorrhynchus ovatus* (strawberry-root weevil); *Typhlocyba rosae* (rose leaf-hopper) on wild and cultivated roses; *Thrips tabaci* (onion thrips); *Phytometra* (*Plusia*) *californica* on lettuces, lucerne and garden vegetables; *Cydia* (*Carpocapsa*) *pomella* (codling moth); *Taxonus nigrosoma* (apple sawfly); *Hyalopterus arundinis* (prune aphis); *Aegeria tipuliformis* (imported currant borer); *Aspidiotus ostreaeformis*; *Aphis sorbi* (the rosy apple aphis); *Epochra canadensis* (currant fruit-fly); *Hylemyia antiqua* (*Pegomia ceparum*) (onion-maggot); *Plutella maculipennis* (diamond-back moth); *Papaipema nebris* (*nitela*) (stalk-borer); *Anthrenus scrophulariae* (carpet-beetle); *Eucosma* (*Tmetocera*) *ocellana* (bud moth); the weevils *Cercopeus artemiseae* and *Mimetes setulosus* on the buds and opening leaves of apple trees; the Buprestid, *Dicerca divaricata* (flat-headed cherry-tree borer); *Aegeria* (*Sanninoidea*) *exitiosa* (peach-borer) and *Anarsia lineatella* (peach-twig borer).

Lyne (W. H.). **The Control of incipient Infestation of Codling-Moth in a new District.**—*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, July 1915, pp. 11–13. [Received 19th November 1915.]

Two methods of control can be used in dealing with incipient infestations of *Cydia pomonella*. These are the destruction of all fruit within the infected area during early summer, and systematic spraying with lead arsenate, banding the trees, and a rigid quarantine of all fruit within the infected district. If infestation is not discovered until late in the season, destruction of fruit is useless, owing to the fact that many of the larvae will have left the fruit and entered crevices of the bark to pupate. The second method, if carried out thoroughly by all growers, should stamp out any new infestation in a short time.

Palmer (L. L.). **Sprays of up-to-date Interest.**—*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, July 1915, pp. 14–16 [Received 19th November 1915.]

Commercial preparations of oil emulsions contain the following constituents:—85 per cent. hydrocarbon oils (paraffin series), 4 per cent. phenols (mostly cresylic acid), and about 11 per cent. inert matter. These emulsions have proved very satisfactory when diluted so that 16 or 20 gals. make 200 gals. spray, and seem to possess the correct physical characteristics which give proper penetration without injury to trees. Emulsions made from crude oil should only be used as dormant insecticide sprays. The formula given for the preparation of crude oil emulsion is—fish-oil or whale-oil soap, 5 lb.; caustic soda, 1 lb.; crude oil, 6 gals.; water, 43 gals. Crude oil frequently contains much foreign matter and should never be used except where it is possible to apply at least 200 lb. pressure. Where a better oil or distillate is obtainable, it should be substituted for the crude oil. If a distillate testing 29° Bé. is used, 4 gals. only are necessary in the above formula.

Treherne (R. C.) **The Tarnished Plant-Bug** (*Lygus pratensis*, **Linn.**). —*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, July 1915, pp. 16–18. [Received 19th November 1915.]

Lygus pratensis, L. (tarnished plant-bug), is prevalent in the Lower Fraser Valley and is a serious pest in greenhouses. It is believed to be the most important agent in transmitting *Bacillus amylovorus* (fire-blight). The details of oviposition in British Columbia are as yet uncertain. The eggs are probably laid in autumn and spring on weeds, which act as host-plants during these periods. The adults are very active during the day and can only be captured in early morning in spring when they are partially dormant. The chief injury occurs on the terminal shoots of peaches, pears, apples, etc., in nurseries, resulting in temporary or permanent cessation of growth. The destruction of weeds in orchards, trapping by sticky shields, and spraying with dilute kerosene emulsion or nicotine extracts at the time when nymphs are present are recommended.

EASTHAM (J. W.). **The Part played by Insects in the Spread of Plant-Diseases.**—*Proc. Entom. Soc., British Columbia, Victoria,* no. 7, July 1915, pp. 18-21. [Received 19th November 1915.]

The spores of injurious fungi may be distributed by the agency of insects, the wounds produced by the latter affording a point of entrance into the plant. The flea-beetle in this way aids in the spread of early blight of potato and tomato, due to *Macrosporium solani*. *Sclerotinia fructigena* (brown-rot) in plum and peach orchards is spread through the agency of *Conotrachelus nenuphar* (plum curculio). Since bacteria have no power of penetrating the cuticle of a plant, the role played by insects as distributing agents is important. *Bacillus tracheiphilus*, causing the wilt disease among Cucurbitaceous plants, is carried by *Diabrotica vittata* and *D. 12-punctata* (striped cucumber beetles). In the case of the fire-blight of apple, pear, etc., the first infections of the season are produced by insect infection of the blossoms. Many kinds of flies and certain night-flying Lepidoptera may serve as carriers of the disease. Examination of comb-honey to determine whether the blight bacillus can live through the winter season in the hive have shown it to be almost uniformly sterile. Whether any relation exists between the number of bees present and the prevalence of blight is at present undetermined. It is possible that if there is a scarcity of flowers in early spring, bees might be attracted to running cankers and thus produce more primary blossom infection. Later in the season the disease is spread by *Lygus pratensis*, Aphids and leaf-hoppers, and in Ontario by *Scolytus rugulosus* (bark beetle).

GETCHELL (F. H.). **Some Insect Pests of the Lower Fraser Valley.**—*Proc. Entom. Soc., British Columbia, Victoria,* no. 7, July 1915, pp. 30-33. [Received 19th November 1915.]

The following insect pests are recorded:—*Eriosoma lanigerum* (woolly aphis), *Eriophyes pyri* (pear-leaf blister-mite), *Eucosma* (*Tmetocera*) *ocellana* (bud moth), *Lepidosaphes ulmi* (oyster-shell scale), *Malacosoma erosa* (tent-caterpillar), *Cacoecia* (*Archips*) *rosaceana* (oblique-banded leaf-roller), *Aphis sorbi* (rosy aphis), and *Enarmonia prunivora* (lesser apple-worm). An account of the more common methods of controlling pests of fruit-trees is appended.

LYNE (W. H.). **Comments on some Peculiarities in Connection with the Life-History of the Codling-Moth on the Pacific Coast.**—*Proc. Entom. Soc., British Columbia, Victoria,* no. 7, July 1915, pp. 33-35. [Received 19th November 1915.]

The majority of the adults of *Cydia pomonella* emerge between 1st July and 15th August, and during the whole season not more than 50 per cent. of the larvae enter the fruit at the calyx. It is thus necessary to spray a second time, about four or six weeks after the first application, in order to destroy larvae hatching from eggs deposited on the fruit. Calyx-infestation is highest in early summer, then gradually decreases. Experiment showed that no larvae left the fruit until the middle of August; the pupating season was over by the middle of September and the numbers of the second brood were so small as to be scarcely recognisable.

TREHERNE (R. C.). **Shade-Tree and Ornamental Insects of British Columbia.**—*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, pp. 35–41. [Received 19th November 1915.]

The following are among the more important insects found on shade and ornamental trees in British Columbia :—Rhynchota : *Lepidosaphes ulmi* (oyster-shell scale), *Aulacaspis rosae* (rose scale), *Pulvinaria innumerabilis* (cottony maple scale), *Aspidiotus ostreaeformis* (European fruit scale), *Lecanium* spp., *Chrysomphalus dictyospermi* and *Lygus pratensis*, (tarnished plant-bug). Lepidoptera: *Cacoecia* (*Archips*) *rosaceana* (oblique-banded leaf-roller), *C. argyrospila* (fruit-tree leaf-roller), *Phytometra californica* (alfalfa-looper), *Vanessa caryae* (west coast painted lady), *Orgyia* (*Hemerocampa*) *antiqua* (tussock moth). *Malacosoma erosa* (tent-caterpillar), *Hyphantria cunea* (fall web-worm), *Lycophotia margaritosa* (*Peridroma saucia*) and *Plutella maculipennis* (diamond-backed moth). Coleoptera: *Otiorrhynchus sulcatus* and *Saperda calcarata* (poplar borer).

WILSON (T.). **The Outbreak of Locusts in 1914.**—*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, July 1915, pp. 41–43. [Received 19th November 1915.]

Orchards in Okanagan suffered severely from an attack of locusts during 1914, *Melanoplus affinis* and *M. femur-rubrum* being the most abundant. Orchards in which clean cultivation was practised were most seriously damaged. Clover, lucerne and hay-crops were also attacked. The outbreak may be attributed to the abnormally hot and dry season experienced, the influx of settlers and the consequent diminution of the natural food of locusts, and too heavy or injudicious grazing, which has destroyed the natural food-plants. The egg-masses are devoured by several species of blister-beetles, notably *Cantharis cyanipennis*. From previous records, severe outbreaks appear to occur every seven years.

TAYLOR (L. E.). **Notes on Birds likely to be of Service in the Destruction of Grasshoppers in the Nicola Valley.**—*Proc. Entom. Soc., British Columbia, Victoria*, no. 7, July 1915, pp. 43–45. [Received 19th November 1915.

This paper gives an account of fifteen species of birds occurring in the Nicola Valley. The food of these species consists largely of grasshoppers, these in some cases forming 42 per cent. of the total.

THEOBALD (F. V.). **New Myrmecophilous Aphides.**—Reprint from *The Entomologist's Record, London*, xxvii, no. 3, 15th March 1915, pp. 52–55. [Received 22nd November 1915.]

The descriptions of the following species of Aphids are given : *Trama donisthorpei* found in the nest of *Tetramorium caespitum* in the Isle of Wight ; *Forda hexagona* from a nest of *Formica fusca* in Cornwall ; *Forda furcata* from a nest of *Myrmica laevinodis* in the Isle of Wight ; *Aphis alienus* from the nests of *Lasius alienus* in South Devon and Cornwall ; *Macrosiphum formicarium* from a nest of *Lasius flavus* in Lundy Island ; and *Aphis leontodoniella* from a nest of *Lasius flavus* at Wye.

Urich (F. W.). Insects affecting the sugar-cane in Trinidad.—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xiv, no. 5, 1915, pp. 156-161. [Received 29th November 1915.]

The following list deals with some of the principal insects affecting the sugar-cane in Trinidad, their natural enemies and methods of control. The adults of *Tomaspis saccharina*, Dist. (sugar-cane frog-hopper), are destroyed by the birds, *Milvulus tyrannus*, and *Crotophaga ani*, several predatory species of ATTIDAE or jumping spiders, a parasitic mite, *Rhyncholophus* sp., the predatory Orthopteron, *Phlugis mantispa*, and a parasitic fungus, *Empusa* sp. The adults and nymphs are attacked by a ground lizard, *Ameiva surinamensis*, a toad, *Bufo marinus*, an ant, *Solenopsis geminata*, and *Metarrhizium anisopliae* (green muscardine fungus). The nymphs are attacked by the predatory toad-bugs (GALGULIDAE), the Syrphid, *Salpingogaster nigra*, a parasitic worm, *Mermis* sp., and an ant, *Anochetus inermis*. Another ant, *Monomorium* sp., preys on the eggs, which are parasitised by the Chalcids, *Oligosita giraulti* (vermilion egg-parasite) and *Paraphelinus tomaspidis* (brown egg-parasite). The only natural enemy of *Castnia licus*, Drury (giant moth borer) is a bird, *Pitangus sulphuratus*, L. The best means of dealing with this pest is to cut out the caterpillars from the cane-stools and catch the moths.

The name of small moth borer is applied to the three species, *Diatraea saccharalis*, F., *D. canella*, Hmp., and *D. lineolata*, Wlk. Natural enemies are the two egg-parasites, *Trichogramma minutum* and a species of *Prophanurus*. The caterpillars are attacked by an undetermined Tachinid fly, a Hymenopteron, *Cyanopterus* sp., and the green muscardine fungus. Control measures include the collection of egg-masses, cutting out the larvae and propagation of parasites.

Mocis (Remigia) repanda, F. (striped grass looper) is destroyed by a bird, *Quiscalus lugubris*, Swains., a lizard, *Ameiva surinamensis*, a toad, *Bufo marinus*, an undetermined Tachinid fly parasitic on the caterpillars, a Chalcid parasitic on the pupae and *Polistes canadensis* (Jack Spaniard). Dusting with Paris green or London purple is effective. Weeding a field when the caterpillars are present, does good, as they are knocked off the canes and exposed to the attacks of birds.

Cirphis humidicola, Guen. (cane-bud caterpillar) is parasitised by an undetermined Hymenopteron; artificial control measures are not necessary against this insect. *Laphygma frugiperda*, S. & A. (corn bud worm, Southern grass worm) is destroyed by insectivorous birds and an undetermined Tachinid fly has been bred from it. It is a more serious pest of maize than of sugar-cane. Dusting with arsenicals is the control advised. Two undetermined species of Hesperid butterflies, commonly known as cane-skippers, are parasitised by two species of Chalcids. They are not present in sufficient numbers to be serious pests. The larvae of a Histerid beetle prey on the larvae of *Metamasius hemipterus*, L. (weevil borer), which never attack healthy canes, but occur in conjunction with *Castnia licus* and *Diatraea*. Seed-cane should always be dipped in Bordeaux mixture before planting. *Myochrous armatus*, Baly (cane-bud beetle), if very numerous, is injurious to seedlings in nurseries, by eating off the young shoots.

Dusting or spraying with lead arsenate is recommended; the vicinity of the nursery should be kept free from all grass. The larvae of *Rhynchophorus palmarum*, L. (gru-gru beetle) are preyed upon by those of a Histerid beetle. It only attacks seed-cane fermenting from excessive moisture or from want of proper treatment before planting. Soaking the plants in Bordeaux mixture is advised. *Xyleborus affinis* (shot-hole borer) never attacks healthy cane, but is generally present on canes suffering from fungoid disease, especially rind fungus. The larvae of *Strategus aloeus* (rhinoceros beetle) are killed by the green muscardine fungus. They rarely attack cane and generally occur in land recently cleared on which there are many decaying tree-trunks. The removal and burning of all rotting wood is advised. The mealy bugs, *Pseudococcus calceolariae*, Mask., and *P. sacchari*, Ckll., are generally kept in check by the Coccinellid, *Scymnus pictus*, Gorh., so that they are never numerous enough on full-grown cane to be injurious. *Aspidiotus sacchari*, Ckll., is parasitised by an undetermined Hymenopteron. This scale mainly occurs on diseased and old canes. *Schistocerca praesignata*, Rehn in MS. (brown grasshopper) is preyed on by several birds, especially the tick bird, *Crotophaga ani*. When numerous, dusting or spraying with arsenicals will effect control. *Conocephaloides* (*Neoconocephalus*) *guttatus* (green cane Katydid) is preyed on by birds, while the eggs are parasitised by a small Hymenopteron. *Homorocorypha* sp., allied to *H. laticeps* (brown cane Katydid), has the same natural enemies. *Delphax* (*Stenocranus*) *saccharivora*, Burm. (cane fly) has never been numerous enough to be classed as a pest. Its nymphs are preyed on by an undetermined Coccinellid and a Dryinid is parasitic on them. *Scapteriscus didactylus*, Latr. (mole-cricket) only attacks young growing plants. The lizard, *Ameiva surinamensis*, the tick bird, *Crotophaga ani*, and toads are natural enemies of it. A poison bait, consisting of flour, 100 lb., and Paris green, $2\frac{1}{2}$ to 3 lb., may be scattered over the land before planting. Among termites, a species of *Calotermes* occurs occasionally on stiff clay soil. Burning all nests found near the cane-stools and in the field before planting is advised.

URICH (F. W.). **The coconut butterfly,** *Brassolis sophorae.*—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xiv, no. 5, 1915, p. 172. [Received 29th November 1915.]

In April and May, a rather severe attack of *Brassolis sophorae* (coconut butterfly) was reported from the east coast of Trinidad. From pupae collected in the central part of the Island, a species of *Chalcis* was reared. The cabbage palms (*Oreodoxa oleracea*) in the Neparima district have been infested with this pest since 1908.

URICH (F. W.). **Parasol ants.**—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xiv, no. 5, 1915, p. 173. [Received 29th November 1915.]

The parasol ants proclaimed under the Plant Protection Ordinance [see this *Review*, Ser. A, iii, p. 72] are *Atta octospinosa* and *A. cephalotes*. The former takes first place as a pest of gardens about Port-of-Spain and other towns. It also occurs on cacao estates, but its depredations

there are insignificant when compared with those of the larger *A. cephalotes*, which is the real cacao pest. A peculiarity of *A. octospinosa* is that it often removes the skin of ripe cacao pods. The best time for destroying the nests with carbon bisulphide is just before the swarming of the winged sexual forms from December to May.

WEISS (H. B.). **The Establishment of Foreign Insects in Spite of Inspection.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 10, October 1915, pp. 313–315.

Two large nurseries at Rutherford, N.Y., annually import large quantities of plants from Europe, Asia and South America. The plants are subsequently distributed to various parts of the United States. All possible precautions are taken to see that no undesirable insects, etc. are introduced, but, in spite of this, the following foreign pests have recently become established in the vicinity of the nurseries: *Phytomyza aquifolii*, Gour., on English holly; *Rhyacionia (Evetria) buoliana*, Schiff. (European pine-shoot moth) on *Pinus magnus*; *Agrilus viridis*, L., var. *fagi*, Ratz., on rose stems; *Aspidiotus tsugae*, Marlatt, on Japanese hemlock and *Myelophilus piniperda*, L., on *Pinus sylvestris*. In 1909, *Dasychira pudibunda*, L. (European red-tail), was bred from a pupa collected near Rutherford. In July 1915, a mole-cricket was found feeding on the roots of plants [see this *Review*, Ser. A, iii, p. 761]. In addition to these foreign species, noxious insects from other parts of the United States occurred at Rutherford, the most important being, the gipsy moth and *Eriopus (Callopistria) floridensis*, Guen. (Florida fern caterpillar). With one or two exceptions, the infestations were slight, but it is only a question of time before they become more troublesome. This paper concludes with a list of the various foreign insect pests which have become established in the United States.

WEISS (H. B.). **Insect Importations into New Jersey during the Spring of 1915.**—*Canadian Entomologist, London, Ont.*, xlvii, no. 10, October 1915, pp. 326–328.

Among a number of insects introduced into New Jersey in nursery stock in the spring of 1915, were the following: *Coccus hesperidum*, L., on bay trees, and *Chrysomphalus dictyospermi*, Morg., on palms, from Belgium; *Lepidosaphes ulmi*, L., on boxwood; *Rhyacionia (Evetria) buoliana*, Schiff., on *Pinus montana*, *P. mughus* and *P. wateriana*; the carnivorous beetles, *Hister stercorarius*, Hoff., in soil round rhododendron roots; the Hydrophilid beetle, *Cercyon haemorrhoidalis*, F., on rhododendrons, from Holland; *Targionia biformis*, Ckll., and *Isosoma orchidearum* on orchids, from Brazil, Colombia and Venezuela; *Aulacaspis rosae*, Bouché, on rose stocks, *Apatela rumicis* on roses, and *A. auricoma* on shrubs, from France; *Parlatoria pergandei*, Ckll., on maples, and *Pseudaonidia paeoniae*, Ckll., on azaleas, from Japan; *Chrysomphalus perseae*, on orchids from Central America; larvae of Ortalid flies and weevils round roots of blue spruce, from Holland; Ichneumonids of the genera *Itoplectis* and *Brachycryptus* from cocoons on azaleas from Japan; these last may prove to be useful parasites.

GILLETTE (C. P.) & LIST (G. M.). **Sixth Annual Report of the State Entomologist of Colorado, for the year 1915.**—*Office of State Entomologist, Fort Collins*, Circular no. 15, June 1915, 44 pp. [Received 22nd November 1915.]

This report includes extracts from the annual reports of the county horticultural inspectors. Many potatoes coming from Texas and California were infested by the potato tuber moth [*Phthorimaea operculella*]. It is doubtful whether this pest would become serious under Colorado climatic conditions. In Boulder county the most injurious pest is the codling moth [*Cydia pomonella*]. The chief difficulty in control is the fact that almost every family has a few trees which are wholly neglected and become breeding places for all pests. In Mesa county the best results against the codling moth appear to have been attained with six applications of spray. It is believed that soil fumigants applied in the dormant season would control the woolly aphis [*Eriosoma lanigerum*] in Mesa county. Satisfactory results were achieved with soluble oil against the leaf-roller in Pueblo county.

Colorado's Amended Pest Law.—*Office of State Entomologist, Fort Collins*, Circular no. 16, August 1915, 8 pp. [Received 22nd November 1915.]

The Pest Inspection Act of 1911 passed by the Colorado General Assembly has been amended in 1915 in order to make it more effective from the resident land-owner's standpoint. Under the old law the formation of a "pest district" required a petition of the majority of the acreage within a township, or an area not exceeding 36 miles. The new law requires a petition bearing the signatures of the majority of resident land-owners, instead of a majority of acreage. A County Inspector may now destroy pests upon the property of those persons who neglect to carry out his orders and the cost incurred may be charged to them. The State Entomologist has jurisdiction within this law, the full text of which is given.

SMITH (L. B.). **Control of the Colorado Potato Beetle (*Leptinotarsa decemlineata*, Say).**—*Virginia Truck Expt. Sta., Norfolk*, Bull. no. 14, 1st January 1915, 19 pp., 5 figs. [Received 24 November 1915.]

This is a summary of the field work during 1914 on spraying experiments against *Leptinotarsa decemlineata*, Say (Colorado potato beetle) in Virginia. As a spray for potatoes, Bordeaux mixture (4–6–50), together with arsenate of lead paste from 4 to 6 lb. and 1 lb. of Paris green to 50 U.S. gals. of mixture, has not yet been surpassed by any of the proprietary insecticides now in use, either from the standpoint of efficiency or of economy, for the farmer who grows 5 acres or more of potatoes. In this case it will pay to have the proper facilities for the mixing of Bordeaux and the application of sprays. For those who grow less than 5 acres, it may be more economical to use some prepared spray material, especially as the facilities for mixing at home are likely to be poor, thus making a spray of mediocre quality. One application of Paris green and lime dust should be made at the time the first green shoots are showing, this will protect the young potato

plants from the ravages of the adult beetles until sufficient foliage is developed for the application of the liquid sprays, which should be used as soon as the plants are from 4 to 8 inches high. These should be applied at least every 10 days and preferably once a week until the crop is ready for harvest. Applying the spray between 9 a.m. and 4 p.m. on bright, clear days, will, to a great extent, eliminate the danger of scorching. The spray should be applied in as fine a mist as possible, so that both sides of the leaves will be coated with the liquid. A high-pressure sprayer is therefore more satisfactory. Great care should be exercised in the mixing and preparation of the spray materials, as many good crops have been ruined through carelessness in this respect.

DAVIS (J. J.). **The pea aphis with relation to forage crops.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 276, 29th September 1915, 67 pp., 17 figs. [Received 22nd November 1915.]

In the United States, *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt. (pea aphis), seems to have made its first appearance in destructive and noticeable numbers in 1899, although it is known to have been present there for at least twenty years previously. The present paper discusses the identity of this species [see this *Review*, Ser. A, iii, p. 702] and gives an account of extended investigations on the life-history. *Macrosiphum trifolii*, Perg., is considered to be identical with *A. pisi*. The following is a list of the authentic food-plants of this Aphid in the United States: *Capsella bursa-pastoris* (shepherd's-purse), *Ervum* sp. (lentil), *Lathyrus odoratus* (sweet pea), *L. sativus* (grass pea), *Medicago sativa* (lucerne), *Melilotus alba* (white sweet clover), *Pisum sativum* (garden pea), *Trifolium incarnatum* (crimson clover), *T. pratense* (red clover), *T. repens* (white clover), *Vicia ludoviciana*, *V. gigantea*, and *V. villosa* (vetches or tares). Clovers serve as hosts for this Aphid throughout the year, and it is on these plants that it usually passes the winter, either as an egg or as a viviparous female; during the summer months, the migrants also pass to other leguminous crops and on these they multiply very rapidly, often destroying large acreages. In the latitude of La Fayette, Ind., *A. pisi* winters both as a viviparous female, usually wingless, and as an egg. Farther north it probably winters exclusively in the egg-stage, while further south, in the latitude of Tennessee, the sexual forms which lay the hibernating eggs are rare. Still further south, only the viviparous females occur and it is believed that viviparous reproduction may occur indefinitely in localities where the winters are sufficiently mild. In the latitude of Illinois, Indiana, Maryland and Delaware, migrants from the winter hosts (red and crimson clovers) begin to spread to new fields of clover and garden peas about 1st May, and injury usually becomes noticeable about 1st June, extending up to July. By that time, parasitic and predaceous enemies are sufficiently numerous to control the Aphid, or at least hold it in check, and a little later the fungus, *Empusa aphidis*, becomes prevalent, so much so that the pest may appear to be exterminated. As weather conditions become more favourable for the Aphid and less so for its enemies, it is usually again abundant by September on clover and late garden peas. Further north, the insect does not appear in injurious numbers until about July. Experiments carried out at

La Fayette in 1912 and 1913, show that on an average 13 generations occur during the year. Both viviparous and oviparous forms are commonly produced by the same mother, and in the same line of generations, reared under exactly identical conditions, reproduction may continue viviparously throughout the winter, while some members of one or more of these generations may become sexual forms. The sexes are, however, never produced at any time except in autumn and early winter. Oviparous females are produced much oftener than males, probably owing to the fact that individual males may fertilise several females. The oviparous females are invariably apterous, but both alate and apterous males occur. In the United States there are no records of the sexual forms being produced or eggs laid on any plants other than red clover and lucerne. *A. pisi* appears to have more enemies than any other Aphid, *Empusa aphidis* being the most important. Driving rains destroy it in great numbers, and very hot, dry weather seems to hinder excessive multiplication. The Coccinellids known to prey upon it are:—*Hippodamia convergens*, Guér., *H. glacialis*, F., *H. 13-punctata*, L., *H. parenthesis*, Say, *Cycloneda munda*, Say, *Coccinella 9-notata*, Hbst., *Megilla fuscilabris*, Muls., *Adalia bipunctata*, L., and *Chilocorus bivulnerus*, Muls. The following Syrphids were recorded by Folsom in 1909 as preying on it, in their larval state:—*Ocyptamus* (*Baccha*) *fuscipennis*, Say, *Platychirus quadratus*, Say, *Syrphus americanus*, Wied., *S. ribesii*, L., *Allograpta obliqua*, Say, *Mesogramma marginatum*, Say, *M. politum*, Say, and *Sphaerophoria cylindrica*, Say. The larvae of three species of lace-wing flies—*Chrysopa oculata*, Say, *C. rufilabris*, Burm., and *C. plorabunda*, Fitch, also feed on *A. pisi*. A Cecidomyiid larva, probably that of *Aphidoletes meridionalis*, Felt, also preys on it, and is the more effective because it does not attempt to consume all of the body juices, as do the Syrphids and Chrysopids, but seems only to feed upon the juices of the prey until it is dead. Other insects known to be predaceous on *A. pisi* are the Pentatomid bugs, *Podisus maculiventris*, Say, and *Euchistus variolarius*, P.B., the Anthocorid, *Triphleps insidiosus*, Say, a tree cricket, *Oecanthus confluens*, H. & H., and a Lampyrid beetle, *Podabrus tomentosus*, Say (*rugulosus*, Lec.) An allied species, *P. pruinosus*, Lec., was reported in 1913 by H. F. Wilson as feeding on what was probably this Aphid. The mite, *Rhyncholophus parvus*, Banks, is also known to attack it. Its parasites include the Braconids, *Aphidius fletcheri*, Ashm., MS., *A. rosae*, Hal., *A. washingtonensis*, Ashm., *Trioxys cerasaphis*, Fitch, and *Praon simulans*, Prov., and the Chalcid, *Megorismus fletcheri*, Cwfd.

If, in spite of natural control, this Aphid should become unduly abundant, the clover should be cut as soon as possible, for cutting and drying will kill most of the insects. This paper closes with a bibliography of 12 European and 159 American works.

BRUNNER (J.). **The Zimmerman Pine Moth.**—*U.S. Dept. Agric. Washington, D.C.*, Bull. no. 295, 28th October 1915, 11 pp., 11 plates.

In various parts of the West of the United States, *Pinipestis zimmermani*, Grote (Zimmerman pine moth) is very destructive to coniferous trees, and especially to *Pinus ponderosa* (yellow pine). It also attacks

Pinus strobus (white pine), *P. resinosa* (Canadian or red pine), *P. austriaca* (Austrian pine), *P. sylvestris* (Scotch pine) and *P. cembra* (Swiss pine). It is largely the cause of "spike-top" in mature timber and stunts and kills outright innumerable trees of the so-called "second growth." The timber of at least one area has been brought into such ill-repute that carpenters and builders refuse to use it for any important purpose. A systematic study of the life-history and habits of this pest was undertaken in the autumn of 1912 and continued in 1913 and 1914. The particulars were collected only in Montana and Idaho, but the moth is probably distributed throughout the United States. The marked variations in colour of the caterpillars appear to be due to the host plant. The chrysalis is without spines on the segments, which readily distinguishes it from an Aegeriid pupa that is frequently found under somewhat similar conditions. The adults are chiefly on the wing from 1st May to 15th September, but fertilised eggs are deposited during any of the milder months and larvae of all sizes, except the most minute in winter, may be found at any time of year. Since no other pitch moth so seriously destructive to the trunks of mature or nearly mature trees, leaves the entire pupal shell *within* the bark or the pitch which sheltered the immature insect, its identity is quite easily determined. The eggs deposited in July appear to hatch within about two weeks. In the latter part of August, the mixture of coarse castings and brown bark dust which is thrown out through the entrance and other holes in the bark indicates the presence of the larva. Unlike the larva of the Aegeriid pitch moths, the caterpillar does not work into the cambium and stay there. After attaining nearly half its full growth it usually leaves its hatching place and drills again, often several feet away from the original spot. Migration is not renewed in spring, each larva preparing for pupation in its own individual tunnel by lining it with silken thread. Pupation takes place about the middle of June. Eggs laid the previous autumn hatch in early spring, the adults appearing during August and September of the same year, while eggs laid in May yield adults early in the following spring. In the northern Rocky Mountain region, *Pissodes schwarzi*, Hopk., is a common associate of this moth in yellow pine, especially when the trees are attacked near the base, as the work of this beetle is rarely found more than 2 or 3 feet from the ground. The result of infestation is identical. *Aegeria (Sesia) brunneri*, Busck, which is at present known in Montana and Idaho, is also associated with *P. zimmermani* in yellow and lodge pole pine.

In Montana and Idaho, *Pinipestis cambiicola*, Dyar, is a most important factor in regard to the existence of *P. zimmermani*. During the latter part of June it infests the cambium of the terminal branches of mature yellow pine, and many of these wounds are reinfested year after year. Its work almost invariably causes the knobby growth on branches in which *P. zimmermani* breeds undisturbed by woodpeckers, and *P. cambiicola* must be therefore regarded as providing brood trees for the more destructive insect. In most parts of the Rocky Mountains *Dryobates villosus monticola* (Rocky Mountain hairy woodpecker) is unquestionably the most efficient natural control of *P. zimmermani*. Woodpeckers, however, never molest caterpillars under "spike-tops" or in knobby branches on certain mature trees and this is evidently the reason why their effects are so limited. The cocoon of an

Ichneumonid, belonging to the subfamily PIMPLINAE, of a new genus and species, is frequently found in the tunnels in Montana and Idaho; and this parasite kills as many as 80 per cent. of the larvae of second-growth trees in some localities. It is as ineffective as the bird for the same reason. Another, somewhat larger parasite, *Ichneumon* sp. n., is frequently found in winter in the chrysalis of the moth. It is less numerous and consequently of still less economic importance.

With the elimination of the main opportunities for propagation, all these agents would check the ravages of the moth in rationally managed woodlands. It is necessary to remove: (1) Trees, which below the spike, show branches with yellow needles—a certain indication of present infestation; (2) those which are struck by lightning and remain green, as the moth usually breeds in great numbers along the lightning scars; and (3) those with knobby growths on branches. Open, sunny stands of timber are those most affected by *P. zimmermani*. It appears to be an absolute necessity to the insects' existence in a locality stocked with second growth that some mature trees should be present which have been left to reseed the area or on account of being unfit for logs, as these constitute brood trees. Out of a hundred trees infested in the West, about 80 per cent. are yellow pine, 15 per cent. lodge-pole pine, and 5 per cent. Douglas fir. Trees with a thick layer of fresh bark and cambium, as well as the more vigorous growers, are preferred for attack. While the mature trees provide the most favourable conditions for this moth, it does the greater damage in smaller ones, up to a foot in diameter. Mature trees are usually attacked from between 10 to 30 feet from the top down and second growth trees from about breast-high up to from 35 to 40 feet.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 10, October 1915, p. 484.

The Coccinellids, *Cryptolaemus montrouzieri*, Muls., *Hyperaspis lateralis*, Muls., and *Scymnus sordidus*, Horn, have been doing effective work against *Pseudococcus citri*, Risso (citrus mealy bug). The solanum mealy bug, *Pseudococcus solani*, Ckll., was reported as injuring tomato vines. *Amphicerus punctipennis*, Lec. (western twig borer), has been found working in prunings from an orange orchard. *Pseudococcus ryani*, Coq. (cypress mealy bug) was being controlled by *H. lateralis*. *Scymnus coniferarum* has been found destroying *Pseudococcus pini*. *S. guttulatus*, Lec., and *S. sordidus*, Horn, were found attacking *Pseudococcus aurilanatus*, Mask. (golden mealy bug), infesting *Araucaria excelsa* (Norfolk Island pine). *S. marginicollis*, Mann., was also observed to attack Coccids. Bamboo was reported to be heavily infested by *Asterolecanium bambusae*, Bdv., in one locality, and in another, camphor trees were attacked by *Chrysomphalus aurantii*, Mask. *Pissodes radiatae* (Monterey pine weevil) was reared from *Pinus silvestris* early in September.

MASKEW (F.). **Quarantine Division, Report for the Month of August 1915.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 10, October 1915, pp. 485–487.

Among the pests intercepted in August 1915 were the following:—*Cyclas formicarius* in sweet potatoes from China; *Pseudococcus*

bromeliae and *Diaspis bromeliae* on pineapples and *Coccus longulus* on betel leaves, from Hawaii; *Lepidosaphes gloveri* on limes and *Calandra oryzae* in beans, from Mexico; *Aspidiotus cydoniae*, *A. cyanophylli* and *Chrysomphalus scutiformis* on bananas, from Central America.

WATSON (J. R.). **Another Migratory Moth (Lep.).**—*Entom. News, Philadelphia*, xxvi, no. 9, November 1915, pp. 419–422.

The study during 1915 of the life-history and distribution of the Noctuid, *Anticarsia gemmatilis*, has resulted in some interesting discoveries. In South Florida, the caterpillars are a great pest of the velvet bean (*Stizolobium* sp.), one of the most valuable leguminous forage and soil-improving plants. It attacks also the kudzu vine and the horse bean (*Canavalia*). The caterpillars and moths begin to do serious injury at Miami in July, and 6 weeks later at Gainesville in North Florida. There they appear in August, but do not become sufficiently abundant to do material damage until 1st September, although the beans are large enough to be attractive as early as May. During the past two seasons a careful search was made through the first seven months of the year, but not a single moth or caterpillar was seen before August. Hundreds of caterpillars were reared in the laboratory during October and November, with special care to protect them from a fungus disease due to *Botrytis rileyi*. These pupae and others collected in the field were kept under conditions as nearly natural as possible. The last moth to emerge from them appeared early in January; the remainder later on being found to be dead. No live pupae could be found in the fields in January. It would therefore seem that the insect dies out each winter to come up again from the south each summer. In reply to a circular enquiry, it was ascertained that no one north of the Gulf States had seen the larvae and that while the moths had been taken as far north as Ontario, all the specimens taken in the North, with one exception, were captured from late September to November. There was no record from the New England States. In the northern States, the moths appear to be most frequently taken in western Pennsylvania and Ohio, *i.e.*, due north of Florida. All the available evidence seems to indicate that *Anticarsia gemmatilis* is a wanderer in the northern States, like *Alabama argillacea*. This moth does not appear to be generally abundant in the West Indies, and apparently is not troublesome in Porto Rico, but is reported to be common in Cuba. *A. gemmatilis* appears to be a sub-tropical species ill-adapted to regions of frost, but it is not the direct action of the cold that exterminates the insect at Gainesville. Pupae lying exposed on the ground were not injured by an exceptionally low temperature of 22°. The factor which prevents their surviving even the mild winter of the latitude of Gainesville is their imperfect hibernation. A few warm days in winter cause the moths to emerge from the pupae, when the absence of food results in their death without progeny. In April, or even late March, the insects would, in many cases, find suitable host-plants before death. It was found that though caterpillars in the laboratory ate sparingly of some of the wild and cultivated leguminaceous plants, lucerne being the least disliked, they would not grow, and undoubtedly all would have died had not

some velvet beans been raised in the greenhouse for them. The ability of *A. gemmatilis* to reach so far north as Canada is to be explained by its longevity. A brief description of the life-history of the insect is given. In September it spends about 3 days in the egg-stage and 21 in the larval, passing through 6 instars. The pupal stage averages between 10 and 11 days in September. As the weather became cooler this time was gradually lengthened.

RAND (F. V.). **Dissemination of Bacterial Wilt of Cucurbits. (Preliminary Note).**—*Jl. Agric. Research, Washington, D.C.*, v, no. 6, 8th November 1915, pp. 257-260, 1 plate.

According to Dr. Erwin F. Smith, leaf-eating insects, especially *Diabrotica vittata*, are the chief agents in the spread of the bacterial wilt of Cucurbitaceous plants. It was suspected that the organism might pass the winter inside the bodies of these hibernating insects. In order to elucidate this point and to develop some practical method of control, the author has further investigated this frequently destructive disease and a number of cage experiments were made. From these it would appear that the wilt bacteria are carried over the winter by the hibernating beetles and inoculated into the cucumbers as they feed upon the young leaves. Only those beetles which have previously fed upon wilted plants convey the disease.

WOODWORTH (C. W.). **The Efficiency of Spray Machinery.**—*California Cultivator, Los Angeles*, xlv, no. 19, 4th November 1915, p. 451, 1 table.

This paper gives an account of the method of testing the efficiency of spraying apparatus by a comparison of the theoretical horse-power with that obtained in actual practice. The method of testing is to find the maximum pressure the engine will exert with all the lines of hose open and the time taken, under these conditions, to fill a 50 gallon barrel. By consulting the table, this result can be compared with the theoretical power and thus the efficiency of the engine may be determined.

WOODWORTH (C. W.). **Time of Fumigation.**—*California Citrograph, Riverside, Cal.*, i, no. 1, October 1915, p. 8, 2 figs.

The eggs of scale-insects were submitted to the action of cyanide gas at varying strengths and for different periods of time. After treatment the gas was allowed to escape from the enclosing capsules and the eggs were left to hatch. The largest number of eggs which hatched had been exposed longest to gas which was too dilute to kill. This stimulative action of dilute gas does not become evident until after at least an hour's treatment. In dealing with stronger gas, it has been found that a double dose gives the same killing effect in approximately one-tenth of the time. In field experiments, the difference in the leakage, which in an average-sized tree is compensated for by a change of 1 oz. in the dose, could be equally well compensated for by a change of 40 per cent. in the time. For example, an 8 oz. dose for 45 minutes would have the same killing power as a 7 oz. dose for 1 hour, or a 9 oz. dose for 32 minutes.

WHITE-HANEY (J.). **Report of the Officer in Charge of the Prickly-Pear Experimental Station, Dulacca, from 1st May 1914 to 30th April 1915.** *Brisbane*, 1915, 49 pp., 30 figs.

In this report, the destruction of prickly-pear through the agency of insects is considered. *Dactylopius (Coccus) indicus*, Green, from Ceylon, and *D. (C.) confusus*, Ckll., from South Africa, reproduced well on small plants of *Opuntia monacantha*. In no instance did any of the small *O. monacantha* plants show signs of sprouting subsequent to their being attacked by the insects; presumably their destruction was therefore complete. In May 1914, a visit was made to North Queensland for the purpose of ascertaining the amount of damage which the wild cochineal insects of Ceylon would be capable of inflicting on the large plants of *O. monacantha*. These investigations are still in progress. Experiments on the propagation of wild cochineal insects on the different species of prickly-pears occurring in Queensland, have up to the present always ended in failure, and the present situation indicates that there is no possibility of acclimatising the insects or of inducing them to multiply on and ultimately destroy the Dulacca prickly pear. The cochineal insects appear incapable of subsisting on plants other than *O. monacantha*.

Zur Bekämpfung des Frostspanners. [On combating *Cheimatobia brumata*.]—*Schweiz Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxiv, no. 22, 26th November 1915, p. 350.

In the Swiss canton of Aargau the supply of adhesives proved inadequate for banding against *Cheimatobia brumata*. The following reliable formulae are given: Burgundy resin, 1 lb.; common turpentine, ¼ lb.; linseed oil, ¼ lb.; crude olive oil, ¼ lb. Mixing is effected over a slow fire and when the mass has cooled it is spread on paper. The second formula contains 13 oz. of cartgrease, 13 oz. of fish oil and 32 oz. of coarse-grained resin. The grease is heated until the water is driven out, a container of at least 4 quarts capacity being used, as the grease rises considerably. The fish-oil is then added, the mass put back on the fire and the resin is stirred in until it melts. The mixture is then set to cool and may be spread on paper the next day.

HARRISON (J. W. H.). **The Psyllidae of the Clevelands.**—*Naturalist, London*, no. 707, December 1915, pp. 400–401.

The following species of PSYLLIDAE are recorded:—*Aphalara calthae*, L., on larch and spruce; *Psyllopsis fraxinicola*, Först., on ash; *P. fraxini*, L., on ash; *Psylla pyricola*, Först., on mountain ash; *P. hartigi*, Flor, on birch; *P. pineti*, Flor, on conifers; *P. melanoneura*, Först., on hawthorn, oak, conifers, etc.; *P. costalis*, Flor, on blackthorn, hawthorn, mountain ash, oak; *P. peregrina*, Först., on hawthorn; *P. mali*, Schm., on crab-apple; *P. alni*, L., on alder; *P. försteri*, Flor, on alder and birch; *P. buxi*, L., on box; *P. spartii*, Guér., and *Arytaena genistae*, Lat., on broom; and *Trioza urticae*, L., on elm and hawthorn.

DE BUSSY (L. P.). **Dierkundige afdeeling.** [Zoological Section.]—*Meded. Deli Proefstat., Medan*, ix, no. 4, October 1915, pp. 112-121.

This is a portion of the Annual Report of the Station for the year ended 1st July 1915. Crops grown in rotation with tobacco suffered severely from tobacco pests. The damage done by *Maruca testulalis* and *Herse* (*Protoparce*) *convolvuli* has been made the subject of special reports [see this *Review*, Ser. A, iii, pp. 248, 644.] These pests were relatively scarce during the past tobacco season, but whether this was due to the action of parasites or of some disease is not clear. A species of *Acherontia* was more than usually in evidence and there is reason to fear that it is spreading to previously uninfested areas. The Noctuid, *Arcilasisa plagiata* seems to have almost entirely disappeared in recent years. In certain tea gardens the Limacodid, *Cania bilinea*, was very common and did a good deal of harm. An undetermined Limacodid closely related to the species of *Belippa* noticed in 1913, attacked one or two coffee plantations. *Trichogramma pretiosum* has been bred with success with the assistance of the eggs of *Mocis* (*Remigia*) *archesia*; another closely allied moth which frequents *Phaseolus radiatus* in large numbers, has also proved to be a host of *Trichogramma*. The trap-crops of maize near tobacco did not yield so many eggs of *Chloridea* (*Heliothis*) as was expected. One or two new indigenous parasites of tobacco pests have been discovered.

With regard to insecticides, the war in Europe has caused the planters to turn to the U.S.A. for supplies, especially of arsenicals. The requirement of the Java experts that Paris green and Urania green should not contain more than 0·4 per cent. of arsenious acid soluble in water as such [see this *Review*, Ser. A, iii, p. 645], is regarded by the European manufacturers as unnecessarily stringent and they point to the good results obtained in Russia on grain crops with much higher percentages; the U.S.A. manufacturers regarded the figures as a clerical error. Izal is of little use against tobacco pests, its action being much too slow; zinc arsenite, on the other hand, as a half per cent. emulsion, was very effective, had no ill effect on the young tobacco plants and may be used in greater strength than Paris green if necessary. The acidity of the tapioca meal used for diluting Paris green is of considerable importance, as it may promote decomposition of the arsenical; it is strongly advised to use the meal as fresh as possible for mixing with Paris green. Aphids have not been very troublesome and it was not found necessary to free any quantity of *Megilla maculata*; experiments on the native Coccinellid, *Chilomenes sexmaculata*, have miscarried. It has now been definitely ascertained that tobacco sent to Holland after fumigation with carbon bisulphide is quite free from the tobacco beetle (*Lasioderma*), and as the cost is small, such fumigation should be always carried out before export. The testing of samples of fermented tobacco for the presence of *Lasioderma* requires 6–8 weeks, this being the maximum period necessary for the development of the insect. *Lasioderma* may apparently be introduced and travel in a number of other materials besides tobacco, and the question of the control of these will require consideration. Tobacco seed has been found to be infested with *Lasioderma*, but fumigation with carbon bisulphide proved satisfactory.

Flint (W. P.). **The Effect of Cyanide on the Locust Borer and the Locust Tree.**—*Science, Lancaster, Penn.*, xlii, no. 1090, 19th November 1915, pp. 726–727. [Received 4th December 1915.]

Experiments were made during the latter part of 1914 and the early part of 1915 in connection with the control of *Cyllene robiniae* (black locust borer), to determine whether at least a part of the borers in infested locust trees might be killed by introducing small amounts of potassium cyanide into the trunk. The trees selected were from one to seven inches in diameter and were badly infested with the larvae of the borer. The cyanide was placed in holes varying from one-quarter to one inch in diameter, bored at different heights from the ground. The chemicals used were pure potassium cyanide in small lumps and cyanide-chloride-carbonate mixture in granular form, containing from 35 to 38 per cent. sodium cyanide. Examination of the trees four months later showed that they had derived no benefit from the treatment. Of the 42 trees examined in July, 19 were living and of these 16 contained living larvae of *C. robiniae*. In several cases, living borers were found close above the holes in which the cyanide had been placed. The death of so many trees was not entirely due to cyanide, although the latter had a very injurious effect, since the bark was dead and the wood discoloured for some distance around the holes. In many cases the portion of the trees round the holes had been gnawed by rodents.

Shevirev (I.). **Note on *Retinia* sp. as a forest pest in Russia.**

With regard to the species of *Rhyacionia* (*Retinia*) infesting the forests of Tambov [see this *Review*, Ser. A, iii, p. 728], Dr. Shevirev writes that *R. duplana* is chiefly concerned, but that the foresters frequently mistake the very similar damage done by a fungus, *Coeoma pinitorquum*, for that caused by the moth. This fungus is much the commoner in Russian forests and he has had many opportunities both from personal observation on the spot and from material sent for examination, to satisfy himself that such is the case.

Keuchenius (P. E.). **Het vraagstuk van de gramangmier (*Plagiolepis longipes*) tevens een kritiek.** [The question of the Gramang Ant (*Plagiolepis longipes*) and a criticism.]—Reprint from *Tijdschrift Teysmannia, Batavia*, 1915, no. 6 and 7, pp. 382-394.

This paper is almost entirely concerned with the question as to whether *P. longipes* should be considered a pest, and the opinions of various authors are cited and criticised. The author has arrived at the conclusion from personal knowledge and observation that *P. longipes* is harmless to cacao and directly useful to coffee because it largely checks the development of red fungus, plays an important part in the spread of the white scale fungus (*Cephalosporium lecanii*) and is predaceous and kills many other insects. For these reasons, it is believed that attempts to control it in cacao and coffee plantations are not only useless, but waste of time and money.

HARLAND (S. C.). **Insect Pests of Lima Beans in St. Vincent.**—*Agric. News, Barbados*, xiv, nos. 352 and 353, 23rd October and 6th November 1915, pp. 346-347 and p. 363. [Received 6th December 1915.]

The most important insect pests of Lima beans are :—An undetermined species of *Cryptorrhynchus*, *Eudamus proteus*, L. (bean leaf-roller), an undetermined blotch leaf-miner and the lima bean caterpillar. The Cryptorrhynchus borer is found in all parts of St. Vincent and in Bequia and attacks *Vigna* (cowpea), *Phaseolus lunatus* (Lima bean), *P. trinervis* (Jerusalem pea) and *P. vulgaris* (haricot bean). The eggs are laid in the node, just below the epidermis. The early larval stage is passed in this position, the stems being tunnelled later. Pupation takes place in the stem. The duration of the larval and pupal periods is two or three weeks. The adults, after emergence, feed on the young shoots and stem, the latter being attacked near the base and below the surface of the ground. Young plants are either completely killed or fail to make further growth. Older plants seem to adapt themselves to the presence of the weevil. The best methods of control appear to be the uprooting and destruction of the native food-plants, *Phaseolus semierectus* and *Vigna luteola*, adjacent to fields. Since the insects remain near the base of the stem, hand collection might be successful. Rotation of crops should be practised.

Eudamus proteus (bean leaf-roller) has been observed on the following additional host plants :—*Desmodium incanum*, *Clitoria* sp., *Vigna catjang* and *Dolichos lablab* (bonavist bean). This insect is controlled by the Braconid *Apanteles* (*Urogaster*) *leucostigmus*, Ashm., which parasitises the larva, and three species of Chalcids, reared from the eggs. The blotch leaf-miner, possibly a species of *Agromyza*, must be regarded as a major pest of Lima beans. Several eggs are laid in a single leaf. The larval stage, which is passed within the leaf tissue, occupies from 6 to 9 days. Pupation takes place in the ground. The pupa is parasitised by a Chalcid.

An unidentified moth attacks the leaves of Lima beans. The larva possesses a leaf-rolling habit; the length of the larval stage is 8 or 9 days, that of the pupal, 6 or 7 days. The host plants are *Clitoria* sp., *Dolichos lablab*, *Vigna catjang*, *Stizolobium aterrimum* (Bengal bean), *Phaseolus mungo* and *P. lunatus*. The pest completely disappears at some seasons of the year owing to the attacks of parasites, including two Chalcids and a Braconid in the larvae and a Chalcid in the pupa. A mixture of starch and lead arsenate (30 to 1) serves as a good means of control.

HARLAND (S. C.). **Starch, instead of Lime, with Paris Green.**—*Agric. News, Barbados*, xiv, no. 353, 6th November 1915, pp. 362-363. [Received 6th November 1915.]

While studying the control of *Laphygma frugiperda*, it was found that if Paris green and lead arsenate were diluted with low grade arrowroot starch, a mixture was formed which seemed to have a deadly effect on all kinds of caterpillars. The greater effectiveness of these mixtures, as compared with those with lime, may be due to the fact that insects usually avoid vegetation where lime is present, until forced by hunger to feed upon it. Starch is also more adhesive than lime

and is insoluble in cold water. The habit of the larvae of *L. frugiperda* of remaining in the heart of the maize plant was made use of in controlling the insect, a small quantity of poison being dropped into the heart of each plant. A mixture of lead arsenate in the proportion of 1 to 30 is recommended for use on young maize, wh.le a 1 to 100 mixture of Paris green and starch can be used on half-grown plants. No injury to the leaves takes place. The Hesperid, *Calpodes ethlius* (arrowroot worm) can be destroyed by Paris green and starch mixture (1 to 60). The ground-nut worm and the Chrysomelid, *Colaspis fastidiosa* (bronze beetle) on cotton have been successfully controlled by a similar mixture.

BALLOU (H. A.). **Report on the Prevalence of some Pests and Diseases in the West Indies during 1914. Part I. Insect Pests.**—*West Indian Bull., Barbados*, xv, no. 2, 1915, pp. 121–147. [Received 7th December 1915.]

The following insect pests are recorded :—On sugar-cane : *Diatraea saccharalis* (moth borer), *Sphenophorus sericeus* (weevil borer), *Diaprepes abbreviatus* and *Exophthalmus esuriens* (root borers), *Lachnosterna patruelis* and *Ligyrus tumulosus* (hard back beetles), *Pseudococcus calceolariae* (mealy bug) and grasshoppers.

On cotton : *Alabama argillacea* (cotton worm), *Chloridea* (*Heliothis*) and *Laphygma frugiperda* (boll and corn ear worm), *Dysdercus andreae* (cotton stainer), *Saissetia nigra* (black scale), *Hemichionaspis minor* (white scale), the Chrysomelid, *Colaspis fastidiosa* (bronze beetle), *Aphis* sp., *Corythuca* sp. (lace-wing bug), *Chrysopa* sp. (lace-wing fly), *Lachnopus* sp., and *Aphis gossypii.*

On cacao : *Heliothrips rubrocinctus*, *Stirastoma depressum*, scale-insects and termites.

On limes : scale-insects, the Longicorn, *Leptostylus praemorsus* (bark borer), *Elaphidion mite* (twig borer), *Diaprepes* and *Exophthalmus.*

On sweet potatoes : *Euscepes* (*Cryptorrhynchus*) *batatae* (scarabee), *Protoparce cingulata*, *Sylepta helcitalis* and *Tetranychus telarius* (red spider).

On ground-nuts : *Nezara viridula* (green bug), mealy bug and *Exophthalmus esuriens.*

On coconuts : *Rhynchophorus palmarum* (weevil), *Aleurodicus cocois* (whitefly), and the scale-insects, *Aspidiotus destructor* and *Vinsonia stellifera.*

On maize : *Laphygma frugiperda* and *Lachnosterna patruelis.*

On yams : *Aspidiotus hartii.* On green crops : *Protoparce cingulata* on *Canavalia ensiformis* (horse beans), *Aphis* sp. on soy bean, and a red spider on *Indigofera suffruticosa* and *C. ensiformis.* Miscellaneous insects included : *Exophthalmus esuriens* on cassava, and the Longicorn, *Batocera rubus*, on *Carica papaya.* The natural enemies of injurious insects included the wasps *Tiphia*, parasitising *Lachnosterna patruelis*, *Dielis dorsata* parasitising hard-back grubs, and the predaceous beetle *Calosoma calidum.* Fungi infesting scale-insects were *Aschersonia turbinata*, *Sphaerostilbe coccophila*, *Cephalosporium lecanii* and *Myriangium duriaei.* A table showing the distribution of these insect pests in the various islands, is appended.

THEOBALD (F. V.). **Notes on new and little-known British Aphides.**—*Entomologist, London*, no. 631, December 1915, pp. 274–275.

Macrosiphum lamii, sp. n., found among the flowers and under the leaves of *Lamium purpureum*, at Wye, Kent, in June 1914, and *Kaltenbachiella menthae*, Schouteden, which produces a flocculent white substance on the roots of *Mentha aquatica*, are described.

ALFARO (A.). **La invasion de langosta.** [The locust invasion.]—Reprint from *Revista de Educacion, San José de Costa Rica*, October 1915, 7 pp. [Received 7th December 1915.]

This paper briefly refers to locust invasions in Costa Rica since 1659. *Schistocerca paranensis* was the species concerned in 1915. An instance is given of its cannibalistic habits. Poisoning with arsenicals is the method advised and the following formula is given: White arsenic in powder, 4 lb., and caustic soda, 1 lb., boiled in 40 gallons of water for ten minutes.

d'HÉRELLE (F.). **La campagne contre les sauterelles en Tunisie en 1915.** [The campaign against locusts in Tunisia in 1915.]—*Bull. Soc. Path. Exot., Paris*, viii, no. 9, 10th November 1915, pp. 629–633. [Received 4th December 1915.]

The locust invasion of 1915, which threatened to be disastrous in Tunisia, was completely controlled by the mechanical and biological measures taken by the Government, the damage done being insignificant, except in a few vineyards in the north which had already suffered from mildew. An area of about 36,000 square miles was involved, and owing to the mobilisation, the author had to carry out the work without an assistant. He decided to start from the Saharan frontier at the end of April when the first swarms were hatching out there, and to work his way northward, infecting a few swarms in each district until reaching the coast, where hatching occurs in July. This system protected the largest number of crops, though it involved the abandonment of the method of infecting all the swarms in a given district, which would have impressed the authorities more. Crops which were directly menaced were saved by mechanical methods, as the effect of the epizootic is not sufficiently rapid to be of use in such cases. In each district a centre was chosen, where the travelling laboratory was established and from which the disease was spread radially, valleys being usually followed for the purpose. By consulting a map on which were marked all the locust columns reported, the author was able to judge which columns were most likely to split up owing to the configuration of the ground. He thus hoped to spread the disease with a minimum number of infections. He covered over 1,800 miles in looking for the locusts and about 400 columns were infected. In certain cases the mortality was so high and so sudden that the natives reported it to the authorities. Although the author was unable to remain sufficiently long at one spot to observe the results, he was able on several occasions to see the effects of a distant infection transmitted to locusts which had passed the infected area.

Béguet (M.), **Musso** (L.) & **Sergent** (Et.). **Troisième campagne contre les Acridiens** (*Schistocerca peregrina*, **Ol.**) **en Algérie au moyen du** *Coccobacillus acridiorum*, **d'Hérelle.** [The third campaign against *Schistocerca peregrina* in Algeria by means of *Coccobacillus acridiorum*.]—*Bull. Soc. Path. Exot., Paris*, viii, no. 9, 10th November 1915, pp. 634–637. [Received 4th December 1915.]

The campaign against locusts by means of *Coccobacillus acridiorum* was conducted in Algeria in 1913 and 1914 for destroying the native species, *Dociostaurus maroccanus*, Thunb. [see this *Review*, Ser. A, iii, p. 118]. In the autumn of 1914 a big invasion of *Schistocerca peregrina*, Ol., entered Algeria, spread through the country and reached the sea in the spring of 1915, giving an opportunity for trying the virus against the identical species from which it was obtained in America by d'Hérelle. It was found to be easy to increase the power of the virus in the laboratory, the best result being obtained with locusts which had died in more than four hours and less than eight. Individuals which died in less than four hours may have succumbed to poisoning and not to septicaemia. Each of the three authors made practical trials in a different region. The total area infected amounted to about 110,000 acres and about 117 gallons of spray were used. The conditions varied throughout the whole period. An unexpected discovery was that of the existence—in locusts which could not possibly have been contaminated in North Africa—of an epizootic of the same group as d'Hérelle's bacillus. Though not deadly, this virus is capable of having its power easily raised. The biological method was found to be useful when combined with those already employed in Algeria against *S. peregrina* and is especially advisable in localities where mechanical control is difficult. It should not be attempted where crops are directly threatened [see above]. The instant and complete destruction of sprayed swarms must not be expected, and no appreciable result is gained in the case of swarms already infected with similar bacilli. The method is only applicable when the locusts are feeding, that is, not before the tenth day of their life, a period corresponding with the end of the third stage, and the value of the results increases with the amount of bait consumed. The best results were noticed in the second half of the life of the locusts, during the last two stages, from the third to the sixth week. The quantity of spray must be proportional to the number of locusts and in inverse proportion to their density; rather less than $\frac{3}{4}$ pint per acre may be taken as a basis. It is useless to spray a single swarm in the hope of infecting all the others in a district. The disease may last for a long time, but it always spreads slowly. Its spread is mainly due to the pronounced cannibalism of *S. peregrina*, which devours the sick and the recently dead. Dessicated bodies are not touched. The indigenous virus, mentioned above, was discovered before the experiments were made; it gave rise to a mild form of epizootic which immunised affected individuals against *C. acridiorum*, so that the latter produced no result in the Sebdou region. Similar infections were also reported from Algiers and other places far distant from Sebdou.

VELU (H.) & BOUIN (A.). **Essais de destruction de *Schistocerca peregrina*, Olivier, au Maroc, par l'emploi des cultures microbiennes (*Coccobacillus acridiorum*, d'Hérelle).** [Trials in destroying *Schistocerca peregrina* in Morocco, by the use of microbe cultures (*Coccobacillus acridiorum*).]—*Bull. Soc. Path. Exot., Paris*, viii, no. 9, 10th November 1915, pp 638–641. [Received 4th December 1915.]

A severe invasion of locusts may cause a loss of several millions of pounds in Morocco. The Government of this French protectorate, on the advance of the pest being notified from Agadir in the autumn of 1914, decided to attempt control in 1915 by means of d'Hérelle's *Coccobacillus*. Dr. Sergent supplied a very virulent culture to the authors for the purpose. Many preliminary tests were made and an area of about 540 square miles was infected on the right bank of the lower reaches of the Oum-er-Rbia. Lack of plant and staff prevented the production and spraying of large quantities of bouillon and this led to a study of the natural means of intercontamination, which were then employed to spread the epizootic. It was found that the virulence varies with the temperature, the age of the inoculated locusts and the age of the culture. A virus which kills in three to four hours at 77°–85° F. requires 8–10 hours at 59°–68° F. A virus which, when inoculated in the abdominal cavity, takes four hours to kill a locust 15 to 20 days old, requires 14 hours in the case of a locust from 30 to 40 days old. The virus keeps long enough to permit of its being used to recommence the passages through a series of insects in order to increase its virulence. Cannibalism is the principal factor in contamination, and in infected swarms this assumes considerable importance, as all the weak and sickly individuals become the prey of the healthy and strong. This explains the rapid transmission of the disease and the difficulty in checking results owing to the almost complete lack of dead bodies. It is possible to create an epizootic centre by placing even a very small number of infected locusts in a swarm of healthy ones. This artificial method allows of dissemination in an entire district being effected far more quickly than by the natural means of contamination. Epizootics thus created are far from being instantaneous in their effects. After an incubation period of varying duration, there is a period in which the incidence of the disease and the mortality are sometimes considerable (disease: 90 per cent.; mortality—in 48 hours, in a cage: 60 per cent.). The swarms advance less speedily and sometimes either stop or break up into two portions: one, composed of the more resistant individuals continues to go on, while the other, comprising the sick and weak individuals, stops. The epizootic then spreads to other swarms up to the end of the development of the locusts or even after the last moult. The effect of the disease then decreases, the incidence remaining constant, but the mortality falling till it sometimes disappears, either owing to an increase of resistance in the individual or by reason of a weakening of the virus. On this account, locusts are at last met with which show a considerable tolerance. They suffer from the specific diarrhoea, but do not die. In these individuals, it is chiefly in the digestive tube that the *Coccobacillus* is found. Its presence in other parts is either rare or non-existent. Success depends mainly on the time at which infection takes place, the most suitable period

being when the locusts are from 15 to 20 days old. At an earlier date contamination is very slight, and later on, individuals of varying ages and resistance are present, so that the virus is weakened. In conclusion, it is stated that the good results yielded by *Coccobacillus acridiorum* are undeniable, and in spite of the many imperfections of this system, it should be largely used against new invasions, in conjunction with other methods.

BENOIST (R.). **Sur l'*Entomognathus brevis*, Lind. [Sphegidae], Hymenoptère chasseur d'Altises.** [On *Entomognathus brevis*, a Hymenopteron predaceous on *Haltica* spp.] — *Bull. Soc. Entom. France, Paris*, no. 15, 13th October 1915, pp. 241–242. [Received 8th December 1915.]

In the nests of the Crabronid, *Entomognathus brevis*, Lind., from 20 to 25 *Haltica* were found in each cell. As a nest contains about 10 cells, large numbers of these beetles must be destroyed by this common wasp.

RITCHIE (W.). **The Smaller Pine Beetle (*Myelophilus minor*, Hart.) in Aberdeenshire.**—*Scottish Naturalist, Edinburgh*, no. 48, December 1915, pp. 352–355, 5 figs.

Specimens of the bark-boring beetle, *Myelophilus minor*, were found in considerable numbers in a Scots pine wood near Aboyne during August 1915. The mother-galleries of this species are cut deeply into the sapwood in a transverse direction, while the larval ones run vertically. When the larvae are mature, the tunnels become transverse. Pupation takes place within the host. Living trees are usually attacked, but occasionally felled logs and stumps serve as food. The larvae are attacked by parasitic Hymenoptera.

IMMS (A. D.). **Notes on Beet or Mangold Fly.**—*Jl. Bd. Agric., London*, xxii, no. 9, December 1915, pp. 881–884.

Pegomyia hyoscyami var *betae*, Curt. (beet fly) occurs over the greater part of the British Isles and is widely distributed throughout Europe. The number of plants attacked is considerable, and includes beet, mangold, spinach and common weeds such as henbane, deadly nightshade, orache, white goosefoot and nettle-leaved goosefoot. The attacks of the fly are intermittent; in some years it is very destructive, at other times its numbers, owing to unknown factors, are reduced to a negligible quantity. [See also this *Review*, Ser. A, ii, p. 616.]

The Turnip Gall Weevil.—*Jl. Bd. Agric., London*, xxii, no. 9, December 1915, pp. 884–887, 5 figs.

Ceuthorrhynchus pleurostigma, Marsh., is frequently a source of considerable loss in turnip and cabbage crops. Adults emerge from the pupae in spring and summer and the females oviposit in or on the roots of the food-plants. The larva, upon hatching, feeds on the root and thus produces a gall. Pupation occurs in the soil. The duration

of the stages varies considerably. The larval period occupies from 4 to 14 weeks and it is sometimes stated that the majority of the larvae leave the galls in autumn, a few only remaining until March. In opposition to this view are the results of observations made in 1914 and 1915, when specimens were received in which most of the galls were still tenanted by larvae, none of which pupated before March. The probable explanation is that a second and possibly a third brood may arise in the late summer. The fact that the insects can pass the winter as either larvae or pupae is of importance in considering means of control. In addition to turnips, mustard, charlock, rape and cabbage, including Savoy and Brussels sprouts, are attacked. Records of injury have been received from most English counties and the insect is well-known in France, Russia and Germany.

The following methods of control are recommended:—(1) Where the turnip crop is attacked, the turnips should be consumed as soon as possible so as to destroy the larvae before they leave the galls. (2) If a cabbage crop is attacked, the stumps and roots should be burned. (3) After an attack, the land should be deeply ploughed, and in the case of a garden, trenching may be resorted to or a soil insecticide dug in. (4) It is better to avoid growing turnips and cabbages on land adjacent to that which has been attacked the previous year, and in no case should affected land be planted with two successive crops which are liable to attack.

RORER (J. B.). **Report by the Mycologist on the Inoculation of Locusts with** *Coccobacillus acridiorum*.—*Bd. Agric., Trinidad and Tobago, Port-of-Spain*, 5th October 1915, 1 p. [Received 9th December 1915.]

A small amount of dried bodies of diseased locusts obtained from the Pasteur Institute, Paris, was macerated in 2 cc. of sterile water. Eight healthy individuals of *Schistocerca paranensis* were inoculated each with one drop of the liquid. A single specimen received a double amount of liquid. Seven locusts, serving as controls, were inoculated with water only. A day later the locust receiving a double amount was dead, the other inoculated specimens were sluggish and voided liquid excrement. The controls were active. Inoculation was continued through the third series of locusts, when death ensued in $4\frac{1}{2}$ hours. The experiments show that the virulence of the organism can be increased for the Venezuelan locust. Similar results were obtained for the giant Trinidad locust.

Recent reports from Venezuela state that the locusts there are migrating inland, and therefore an invasion of Trinidad is not anticipated. It is, however, considered advisable to spray food-plants with cultures of the bacillus when the young hoppers begin to hatch out next year.

The Control of Ants which take away Onion Seed.—*Agric. News, Barbados*, xiv, no. 354, 20th November 1915, p. 378.

Two species of ants are responsible for the destruction of onion seeds in St. Vincent. For the control of these insects, it is recommended that they be burnt off by spreading a layer of dry grass over the beds and setting fire to this. After burning, a few seeds should be placed

on pieces of paper in various parts of the field and kept under observation. Experiments in poisoning the ants with acetylene gas have shown that this method of control is impracticable and gives uncertain results. Vaporite sprinkled over the seed-bed exercised a deterrent action for a short time, but the effect soon disappeared. Attempts to attract the ants to various baits met with success and pieces of ripe avocado pear and meat attracted them in large numbers. These ants are more likely to be abundant in newly cleared land or in land in which maize, cotton or sugar-cane has been grown.

de Charmoy (D. d'E.). **Insects injurious to stored Grain in Mauritius.** —*Dept. Agric., Mauritius, Port Louis*, Bull. no. 2, June 1915, p. 16, 8 figs. 1 plate. [Received 16th December 1915.]

The most important insect pests of maize in Mauritius are *Calandra oryzae* (rice weevil), *Dinoderus minutus* (maize beetle or bamboo borer) and the maize Tineid. The life-cycle of *C. oryzae* in Mauritius lasts 30 or 40 days; it is shorter in summer than in winter and varies with the locality. The number of generations produced annually varies from six to eight on the sea-coast, while in more elevated districts it is probably less. Maize is most severely attacked by this insect when it has been shelled and dried. If kept in cobs, in well lighted and ventilated stores, it remains a longer time without becoming infested. *D. minutus* is a cosmopolitan species, having been recorded in Guadeloupe, Java, India, Brazil and Tahiti. Reproduction occurs throughout the year, the maximum number of generations produced being about seven. Besides treatment with carbon bisulphide, it is advisable, in places where maize is stored, to destroy all dry bamboos used as fences or otherwise. The cob is frequently attacked by the maize Tineid before harvest. The life-cycle is passed within the central core of the cob. Maize kept in cob and heaped in dark and damp spots is thus much more liable to attack than shelled maize kept in well-lighted stores.

Rice is attacked by *C. oryzae* and by *Ephestia cahiritella*. As a remedy for the former species, sulphur dioxide appears to be the most practical and economical compound to use as a fumigant. *E. cahiritella* occurs also in India, in rice and flour, and in Egypt and America, where dried fruits, almonds, nuts and cacao-beans are attacked.

Seeds of leguminous plants, e.g. *Cicer arietum* (gram), *Phaseolus vulgaris* (French bean), peas, *Vigna catjang* (cowpea), and *Cajanus indicus* (pigeon pea) are attacked by the beetles, *Bruchus obtectus*, *B. chinensis* and *B. quadrimaculatus*. The initial infection of the seeds takes place in the field, when the eggs are deposited on the pods. Hatching takes place in from four to six days. The larva at once enters the pod and feeds on the seeds. The duration of the larval stage is from two to three weeks. The nymphal stage lasts five or six days in summer. Bran, flour and other foodstuffs are injured by *Sylvanus signatus* and *S. surinamensis* (saw-toothed grain beetles) and *Tribolium ferrugineum* (flour beetle). A brief account of remedial measures against these insects is given.

HUNTER (A. T.). **An Earth Pit for the Destruction of Fly-infested Fruit.** —*Agric. Gaz. of New South Wales, Sydney,* xxvi, no. 10, October 1915, pp. 889-890, 2 figs. [Received 10th December 1915.]

A pit for the destruction of fly-infested fruit in orchards is dug about 18 inches wide, 6 feet long and 4 feet deep. The top, except for about 10 inches at one end, is covered with a sheet of iron. A fire is made at the bottom of the pit and the waste fruit filled in from above. An incinerator built of brick, stone or concrete, suitable for level ground, should be about 4 feet by 2½ feet inside and 4 feet high. Iron bars are built in 1 foot above the ground level. The fire is made under the bars and the fruit put in from above.

ROSS (W. A.). **Asparagus Beetle Egg Parasite.**—*Agric. Gaz. Canada, Ottawa,* ii, no. 11, November 1915, pp. 1055–1056, 3 figs.

In June 1915, a Chalcid was found destroying the eggs of *Crioceris asparagi*, L. (asparagus beetle) at Vineland Station, Ontario, which has been determined as *Tetrastichus asparagi*, Cwfd., a species not previously recorded from Canada. Its work at Vineland was so effective that spraying was not required.

WATSON (J. R.). **Cyanamide as a Means of controlling Root-Knot.**—*Florida Grower, Tampa,* 9th October 1915, pp. 16–17. [Received 7th December 1915.]

The value of cyanamide in the control of soil pests, especially Nematodes, was tested by the application of from 600 to 1,000 lb. per acre; it was thus found possible to grow some kinds of susceptible plants on heavily infected soil. Used in large quantities, a compound, dicyanamide, was formed, which was more stable and therefore injurious to the growth of some plants. The Nematodes could not however be entirely exterminated by the use of cyanamide.

BROCK (A. A.). **Fumigation in Ventura County and its Cost.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 11, November 1915, p. 522.

Fumigation of citrus plantations should be carried out, where hatching of scale-insects takes place evenly, between 1st September and 1st January. Where hatching is uneven, it should be undertaken when it is possible to kill the largest percentage. An early fumigation, followed by a later one, may give good results in such a case. The length of time between fumigations depends largely on the uniformity of the hatching. If properly carried out, once every two years should be sufficient. The average cost for large trees is about one shilling per tree.

SMITH (H. S.). **Recent Ladybird Introductions.**—*Mthly. Bull. Cal. State Commiss. Hortic. Sacramento,* iv, no. 11, November 1915, pp. 523–525, 3 figs.

Two Coccinellids recently introduced into California from Italy against scale-insects, are *Chilocorus bipustulatus*, L. and *Exochomus*

quadripustulatus, L. The former inhabits the whole of Europe and Northern Asia. In Italy it chiefly attacks *Filippia oleae*, *Pollinia polleni*, *Aspidiotus ostreaeformis* (*betulae*) and *Aulacaspis* (*Diaspis*) *pentagona*. In Italy there are three generations a year. In Europe, the insect is attacked by the Chalcidoid parasites, *Homalotylus flaminius*, Dalm., and *Tetrastichus epilachnae*, Giard. The eggs are also destroyed by mites.

E. quadripustulatus occurs throughout Europe and is similar in habits to *C. bipustulatus*. Both species have been liberated in orchards of lemon, orange, and olive trees, the citrus being infested with *Coccus citricola*, Campb., and the olives with *Saissetia oleae*, Bern.

SMITH (H. S.). **Progress of the Sicilian Mealy Bug Parasite.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 11, November 1915, pp. 525-527, 1 fig.

Paraleptomastix abnormis, Gir., a Chalcidoid parasite of *Pseudococcus citri* (mealy bug) has been successfully reared in California and liberated in infested orchards. At San Diego, on trees which had been fumigated two weeks before observations were made, the remains of mealy bugs from which the parasites had issued, were found. This seems to show that probably the full-fed larvae and the pupae, at least, are resistant to hydrocyanic acid gas. Its apparent resistance to fumigation and the aversion shown by predaceous Coccinellids for mealy bugs parasitised by it, after a certain stage of development is reached, renders this insect especially suitable under California conditions.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 11, November 1915, p. 528.

The following insects are recorded from various localities in California:—*Eriophyes pyri* (pear-leaf blister mite) on the bud scales of pear; *Desmia funeralis* (grape leaf-folder) on grape-vines; *Bryobia pratensis* (brown mite) on pear and peach; the Microlepidoptera, *Cydia* (*Mellisopus*) *latiferreana*, Wlsm., on *Prunus integrifolia*, and *Eucosma* (*Cydia*) *cupressana*, Kear., on Lawson cypress; the Coccinellid, *Delphastus catalinae*, feeding on an Aleurodid, attacking *Prunus integrifolia*; *Aspidiotus camelliae*, Sign., on ornamental evergreens; *Baccha lemur* (lemur Syrphid) predaceous on *Pseudococcus aurilanatus* (golden mealy bug) on Norfolk Island pine; *Scymnus guttulatus*, Lec., and *S. sordidus*, Horn, preying on *P. aurilanatus*; *Scymnophagus townsendi*, Ashm., bred from the pupae of *Scymnus guttulatus*; a Lepidopterous larva, probably *Acleris* sp., on *Sequoia gigantea* and Monterey cypress; *Stethorus vagans*, Blackb., feeding on *Bryobia pratensis*; *Anarsia lineatella*, Zeller (peach twig borer) on the fruit of the Satsuma plum.

MASKEW (F.). **Quarantine Division, Report for the Month of September 1915.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 11, November 1915, pp. 529-530.

The pests intercepted were:—From Celebes: *Aspidiotus* sp., on orchids. From China: *Cylas formicarius* in sweet potatoes and

Lepidopterous larvae in dried fruits. From Guatemala: *Chrysomphalus dictyospermi* and *Pseudococcus* sp. on orchids. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapple, *Coccus longulus* on betel leaves, weevil larvae in beans, Trypetid larvae in tomatoes, and *Pseudococcus* sp. on coconut palm. From Japan: *Pseudaonidia duplex* var. *camelliae* on camellia and weevil larvae in chestnuts. From Mexico: Lepidopterous larvae in garlic and dried fruit, and *Calandra* sp. in tamarind seed. From Tahiti: larvae of borers in orange wood. From Washington: *Lepidosaphes beckii* on apples. From Central America: *Chrysomphalus scutiformis, Aspidiotus cydoniae, A. cyanophylli* and *Pseudococcus* sp. on bananas. From Ohio: *Pseudococcus* sp. on wistaria. From Louisiana: *Aspidiotus cyanophylli* and *Pseudococcus* sp. on bananas. From New York: *Pseudococcus* sp. on Cape jessamine.

EHRHORN (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu,* xii, no. 11, November 1915, pp. 278-281.

In August 1915, thirty-one packages of fruit and nine of vegetables were taken from the luggage of passengers and burnt. The following pests came from Japan: Weevils in a parcel of chestnuts brought in luggage; the pea weevil in three parcels of garden peas. From Singapore: *Pseudococcus virgatus* (striped mealy bug) on orchids in the packing of which an ant's nest (*Tetramorium guineense*), a Carabid beetle, a cockroach, a Dermestid beetle, a few spiders and some millipedes were also found; another shipment was infested with mealy bugs and scale-insects and in the packing was a leaf-eating beetle and some ants (*Prenolepis* sp.).

During the month, 30,514 parasites of the fruit fly were bred and 28,914 were liberated. A total of 7,500 parasites of the horn, house and stable flies were liberated. The grand total of all liberations of parasites, including large numbers of *Opius humilis*, exceeded 36,414 individuals. The author has brought back from California a very large colony of *Leptomastix histrio* (mealy bug parasite), the breeding and liberation of which are being carried out.

HEBARD (M.) **Dermaptera and Orthoptera Found in the Vicinity of Miami, Florida, in March 1915. (Part II).**—*Entom. News, Philadelphia,* xxvi, no. 10, December 1915, pp. 457-469.

The specimens of *Scapteriscus abbreviatus*, Scudder, here described, were dug out of sandy soil in a plantation of grape fruit. The burrows are only a few inches below the surface of the ground and the insects come to the surface to feed beneath decaying grape fruit. Although the numbers caught were not large, the ground was tunnelled in all directions. Locally this insect is called the "Cricket Mole" and is said to be definitely injurious to farm crops. It is said not to be indigenous, but to have been accidentally imported in manure from Key West.

LIZER (Carlos). *Heliothrips haemorrhoidalis* **injurious to Ornamental Plants in the Province of Buenos Aires, Argentina.**—Abstract from *Agronomia, Buenos Aires*, 1915, vi, no. 36–38, pp. 9–11, 3 figs., —*Mthly. Bull. Agric. & Pl. Dis., Rome*, vi, November 1915.

The author first noted the presence of *Heliothrips haemorrhoidalis*, Bch., some years ago on *Euonymus*. He did not attribute to this insect the importance it has in certain parts of Europe, as the number of individuals was limited and the host plant seemed none the worse for their presence. At the beginning of January 1915, leaves of *Pelargonium peltatum* and *Lagerstroemia indica* were received, upon which these thrips were present in very large numbers and were causing withering of the leaves. Against this pest, 1 per cent. tobacco extract in soft soap and water is successful, care being taken to wet the undersides of the leaves, where the larvae and adult insects mainly congregate. As it is impossible to reach the eggs, which are well protected by the epidermis of the leaf, the treatment must be repeated about once a week. In greenhouses, where there are no very delicate plants, recourse can be had to fumigation with some preparation of tobacco.

ARENS (P.). *Dactylopius adonidum* **on Coffee in Java.**—Abstract from *Meded. v. h. Proefst., Malang, Soerabaia*, 1914, no. 7, pp. 20-24. —*Mthly. Bull. Agric. Intell. & Pl. Dis., Rome*, vi, November 1915.

During the long drought of the last few years, *Pseudococcus* (*Dactylopius*) *adonidum* has increased to such an extent as to cause much injury to many coffee plantations. This scale-insect punctures the berries, which turn black and fall off. It has also been found on the tips of young shoots and may kill older plants by attacking their roots. During the rainy season, most of the plantations suffer but little from this pest. Its spread has been favoured not only by the dryness of the last few years, but also by the increasing use of lamtoro (*Leucaena glauca*) as a shade-tree instead of dadap (*Erythrina* sp.). A petroleum emulsion has been used with complete success in the control of this scale.

Entomologia Agraria, manuale sugli insetti nocivi alle piante coltivate, campestri, ortensi e loro prodotti e modo di combatterli. [Agricultural Entomology, a manual of insects injurious to cultivated plants, field and garden crops and their products, and methods of controlling them.]—Edited by the Royal Entomological Station at Florence, *Florence*, 1915, 484 pp., 4to., 415 figs., price 3 lire. [Received 17th December 1915.]

The Director of the Station, Professor A. Berlese, who writes the preface to this book on Italian insect pests, points out that the enormous losses to agriculture caused by insects in the past have been either all but neglected, or treated as inevitable. This state of affairs is now entirely changed and economic entomology has become a well established branch of science. The object of this book is to put a clear statement of the relation of insects to plants of all kinds in the hands of the cultivator, to point out the evil which has resulted from the unrestricted circulation of merchandise

of all kinds, without regard to the spread thereby of insect pests, the necessity for a close study of the bionomics of known injurious species, and lastly to persuade the public and especially agriculturists, of the importance of the subject, and the need for the systematisation of control methods by suitable laws and official regulations.

The work, which is intended for lay readers rather than for entomologists, is arranged on practical lines. The first chapter deals with the general characters of insects, their structure, and the technical terminology used with regard to them; classification occupies the second chapter. The third is devoted to a general view of insects in the economy of nature and the fourth to a brief account of the chief types of damage done. The next deals with the natural conditions which limit the multiplication of the pests of agriculture, climatic conditions, forms and habits of the pest themselves, parasites and predatory insects, and the more or less artificial conditions of modern agriculture and commerce, which frequently favour and occasionally operate against the spread of a pest. Chapter six gives a general view of the methods most in use for the control of insect pests, and a list of 26 formulae for insecticides with brief instructions for preparation. The seventh chapter gives a list of pests arranged under the plants and the parts of them attacked, the nature of the damage being briefly indicated; this important section occupies 54 pages. The remainder of the book is devoted to descriptions of individual insect pests with careful accounts of the damage done by them and the methods of control. A few pages at the end contain a brief account of injurious worms, molluscs and rodents. The Italian law of 26th June 1913, No. 888, which makes provision for the control of insect pests and plant diseases is given in full, as is also that of 15th June 1911 against locusts. The index is almost entirely confined to insect names and, on a rough estimate, includes at least 1,500 species. The illustrations are exceedingly good and the book provides a mass of valuable information for less than half-a-crown.

VIDAL Y FERRER (F.). **La mosca del olivo** (*Dacus oleae*). [The olive fly.]—*Rev. Inst. Agricola Cat. S. Isidro, Barcelona*, lxiv, no. 19, 5th October 1915, pp. 312–313. [Received 15th December 1915.]

The poison bait recommended against *Dacus oleae* (olive fly), consists of:—Water, 100 parts; molasses, 10 parts; sodium arsenite, 2 parts. Sea-water is said to be the best for the purpose as it has been found to be more attractive to the fly than fresh water.

SILVESTRI (F.). **Struttura dell'ovo e prime fasi di sviluppo di alcuni Imenotteri parassiti.** [The egg structure and first phases of development of some parasitic Hymenoptera.]—*Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, x, 1915, pp. 66–88, 6 plates.

In this note are discussed the egg-structure and early stages of development of the five Chalcids: *Encyrtus mayri*, Masi, parasitic on the Gracilariid moth, *Parectopa latifoliella*, Mill. (*Oecophyllembius*

neglectus, Silv.); *Encarsia partenopea*, Masi, parasitic on *Aleurodes brassicae*, Walk., and *Siphoninus* (*Aleurodes*) *phyllireae*, Halid.; *Prospaltella conjugata*, Masi, also parasitic on *A. brassicae*; *Prospaltella berlesei*, How., parasitic on *Aulacaspis pentagona*; and *Anaphoidea luna*, Girault, parasitic in the egg of *Hypera* (*Phytonomus*) *variabilis*, Herbst. A bibliography of 15 works concludes this paper.

THOMPSON (W. R.). **Sur les formes larvaires de *Digonichaeta setipennis*, Fall., Diptère parasite de *Forficula auricularia*, L.** [The larval forms of *Digonichaeta setipennis*, Fall., a Dipterous parasite of *Forficula auricularia*, L.]—*C. R. Soc. Biol., Paris*, lxxviii, no. 18, 3rd December 1915, pp. 602-605, 1 fig.

In 1859, Boheman recorded that *F. auricularia* was parasitised by *Digonichaeta setipennis*. The only other study of this parasite is that of Pantel (1910–1913). The present paper gives a full account of the larval forms, which had not previously been described in detail.

Pour lutter contre la cochylis et l'eudémis. [The control of *Clysia ambiguella* and *Polychrosis botrana*.]—*La Vie Agric. et Rur., Paris*, v, no. 24, 11th December 1915, p. 440.

In reply to a question whether a prize of £4,000 should not be offered for the best remedy against *Clysia ambiguella* and *Polychrosis botrana*, the French Minister of Agriculture stated that arsenical and nicotine preparations are the most efficient known at present, but that possibly something better may be discovered, although a method capable of annihilating these old-established pests does not appear probable. The question of control will be more surely solved by a systematic study of the bionomics of these insects than by the institution of a prize open to the public. It therefore seems better to increase the funds of the laboratories and stations of the Service des Epiphyties and to found a Phytopathological Institute such as those established in other countries.

MAXIMOV (F.). **О состояніи плодоводства и огородничества въ Ардатовскомъ уѣздѣ Нижегородской губерніи.** [On the state of Fruit-growing and Market-gardening in the Ardatovsk district of the govt. of Nijni-Novgorod.]—**« Плодоводство.»** [*Fruit-growing*], *Petrograd*, nos. 9 and 10, September and October 1915, pp. 522–528. [Received 4th December 1915.]

The orchards in Nijni-Novgorod are greatly injured by various insect pests, including *Cydia pomonella, Hyponomeuta malinellus, Psylla*, Aphids, *Anthonomus pomorum*, etc.

SIROMOLOT (P.). **Культура дыни-канталупы въ Енотаевскомъ уѣздѣ Астраханской губ.** [The cultivation of cantaloup melons in the Enotaievsk district of the govt. of Astrachan.]—**« Плодоводство.»** [*Fruit-growing*], *Petrograd*, nos. 9 and 10 September and October 1915, pp. 536–551. [Received 4th December 1915.]

Various pests are mentioned as likely to appear yearly and to affect the yield of the crop of melons. Against Aphids, spraying twice with

quassia solution or soft soap, as well as with tobacco extract, is advised; control measures should be begun immediately these pests are noticed and before the plants become large. *Gryllotalpa* destroys the seeds and young plants and gnaws the roots; the placing of maize grains poisoned with arsenic in the same holes as the cantaloupe-seeds is considered the best remedy.

О насѣкомыхъ, вредящихъ зерну хлѣбныхъ растеній въ амбарахъ и складахъ, и нѣкоторыя мѣры борьбы съ ними. [Insects injuring grain in stores and warehouses, and some remedies for them.]—**«Подольскій Хозяинъ.»** [*The Podolian Farmer*], *Vinnitza*, nos. 9 and 10, September and October 1915, pp. 36–37. [Received 8th December 1915.]

The chief pests of grain in stores in the government of Podolia are *Calandra granaria*, L., *Tinea granella*, L., and *Tryoglyphus farinae*, Koch, and this note gives a short account of their life-history and of the usual remedies for them.

KRAINSKY (S. B.). **Главнѣйшіе вредители плодоваго сада и борьба съ ними.** [The chief pests of orchards and their control.]—Supplement to **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing & Market-Gardening*], *Petrograd*, 1915, 78 figs.

This is a series of tables with figures of *Aporia crataegi*, *Euproctis chrysorrhoea*, *Malacosoma neustria*, *Lymantria* (*Ocneria*) *dispar*, *Hyponomeuta malinellus*, *Cydia pomonella*, *Cheimatobia brumata*, *Melolontha melolontha*, *Rhynchites pauxillus*, *Anthonomus pomorum*, *Aphis pomi* (*mali*), *Psylla mali* and *P. pyri* in their various stages, accompanied in each case by short notes on the respective damage and remedies. Sprayers, trap-belts, etc. are also figured and insecticides described.

PACZOSKI (J. K.). **Обзоръ враговъ сельскаго хозяйства Херсонской губерніи и отчетъ по Естественно-Историческому Музею за 1914-15 годъ.** [Review of pests of Agriculture in the govt. of Cherson and Report of the Natural-History Museum for 1914–15]. *Cherson* 1915, 17 pp. [Received 14th December 1915.]

A large outbreak of *Anisoplia austriaca* occurred in 1915 in the southern part of the government, the northern one being practically free from the pest. *Pyrausta nubilalis* (*Botys silacealis*) appears yearly in increasing numbers, owing to the more extensive cultivation of maize and to the fact that the maize-straw, in which the larvae winter, is usually left undestroyed; the observations of this year have shown that the caterpillars can live for a long time, practically during the whole summer, without pupating, should the conditions be unfavourable for this process. The Pyralid, *Cledeobia moldavica*, Esp., seriously injured steppe grasses, such as *Festuca ovina sulcata*, Hackl., and, to a less degree, *Stipa capillata*, L., while other species of *Stipa* and other steppe grasses and plants were not injured. The damage

by this pest was noticed on a large plot of uncultivated land, the number of caterpillars in May, when the author visited the particular estate, being very great; as the caterpillars live in the upper strata of the soil, and, when pupating, attach the upper ends of their web bags to the entrance to their hole, practically at the surface, the burning of straw appeared to be a practicable remedy, but in order to be effective, the layer of straw ought to have a thickness of about from 3 to 3½ feet; 21 inches of straw had no effect. *Entomoscelis adonidis* appeared in some parts of the government, doing, however, no damage, as no rape, to which it is particularly dangerous, was being cultivated in these localities; the beetle fed mostly on *Thymus marschallianus*, the economic importance of which is not great, and on some wild Cruciferae, thus proving even useful in clearing the fields of these weeds. *Phlyctaenodes sticticalis*, L. was present, but no damage to cultivated plants was reported.

The following Lepidopterous pests appeared in orchards: *Euproctis chrysorrhoea*, *Malacosoma neustria*, *Hyponomeuta malinellus*, *H. variabilis*, *Cydia pomonella*, etc. It is reported that *Eulecanium robiniarum*, Dougl., is again increasing; this was a serious pest in previous years, but the larvae were almost totally destroyed in 1912 by a sudden "silver thaw" in October when the leaves were still on the trees.

BORODIN (D. N.). **Массовое появленіе пшеничнаго комарика въ 1914 году.** [An outbreak of *Contarinia tritici*, Kirby, in 1914.] **«Хозяйство.»** [*Husbandry*], *Kiev*, nos. 43–44, 26th November 1915, pp. 1022–1029.

Contarinia tritici, Kirby, has not been previously reported as a pest of grain in Russia, the dependence of this Cecidomyid fly on meteorological conditions and the great activity of its parasites being probably largely responsible for the small attention paid to it. In the government of Poltava, it was first noticed in 1912, and again in 1913, when it did very little damage, but in 1914 it occurred in great numbers both in that government and in some of the neighbouring ones. The insects were on the wing between 22nd May and 2nd June, when oviposition took place; the first larvae were reported on 17th June and appeared in large numbers on and about the 25th June; they entered the earth about 3rd July. Some experiments with the larvae confirmed the fact that damp, and perhaps rain only, may have an influence on the time at which the larvae enter the earth; in dry weather, pupation may be delayed and the larvae remain longer in the ears of grain. The following parasites were reared from the puparia of this pest: *Geniocerus brevicornis*, Nees, *G. clavicornis*, Thoms., and *Geniocerus* sp. The author gives also a list of the parasites recorded by Kirby, Marchal, Webster and other authors. A comparative table showing the results of infestation by some of the chief pests of grain are given. The loss in the weight of grains of the infested plants and the loss in the weight of the harvest, if 10 per cent. of the plants are infested, being respectively 5 per cent. and 0·5 per cent. for the saw-fly, *Pachynematus clitellatus*, Lep.; 10 per cent. and 14 per cent. for *Isosoma*; 40 per cent. and 1 per cent. for the Hessian fly (*Mayetiola destructor*); and 50 per cent. and 5 per cent. for *Chlorops taeniopus*, Meig. All these pests attack the stems, and as they interfere with the vigour of the

plant, they decrease the weight of the grain, but do not actually destroy it. *Contarinia tritici*, on the other hand attacks the grain directly and destroys it, and although this may lead to a slight increase in the weight of the uninfested grain, it can in no case compensate for the actual damage done.

Gomilevsky (V.). **Ядовитыя растенія, изъ которыхъ можно извлекать составы для борьбы съ вредителями сада.** [Poisonous plants, from which insecticides for orchard-pests may be prepared.]—**«Садовая Библіотека.»** [*Orchard Library Series*].—Supplement to **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing & Market-gardening*], *Petrograd*, 1915, 32 pp.

The principal poisonous plants of the Russian flora are described with special reference to their medical and economic importance, and particularly as regards their possible use as insecticides and fungicides. The poisonous quality of the fungus, *Claviceps purpurea*, depends, according to some authors, not so much upon the ergotin and ecboline contained in it, but on the presence of ethereal oils. An extract of this plant, in the proportion of about 1 part to 10 parts by weight of water, kills Aphids, *Psylla*, thrips and probably also other sucking insects and those unprotected by hairs. The poisonous qualities of *Amanita muscaria* probably depend on the presence of volatile matter and the alkaloid amanitine (muscarine). An extract of the whole fungus is likely to prove effective against all kinds of gnawing insects and their larvae. The spores of *Lycoperdon bovista* may be used in the same way as flowers of sulphur; insects covered with this powder either perish from its mechanical effects or are poisoned by it. As the foliage of *Taxus baccata* (yew) is not eaten by insects, it is suggested that dusting with a powder of the dried leaves or spraying with an extract of them may prove effective against insect pests. An extract of *Colchicum autumnale* (meadow saffron) contains the poisonous alkaloid colchicine, the solution of which is facilitated by the addition of alcohol; molasses may be added to the liquid to make it adhesive. A fine powder prepared from the stalks of *Veratrum album*, L. (white hellebore) is now used as a fungicide and insecticide in America; an extract of this powder (about 1 oz. in 3 gallons of water) is considered preferable, as the powder is highly poisonous. *Daphne mezereum*, L. (spurge-flax) is well known in medicine; the author has never observed any insects on this plant, but frequently found underneath it dead beetles, flies and wasps; he suggests experimenting with an extract of the berries or bark or even of the whole plant on various forest pests, such as *Lymantria dispar*, *L.* (*Psilura*) *monacha*, *Malacosoma neustria*, etc. *Aconitum napellus* (monk's-hood) is also suggested as a possible insecticide; some years ago the author witnessed the deadly effect of a few drops of an extract of this plant on stag beetles, *Lucanus cervus*, the solution being dropped on the junction of the thorax and abdomen. To prepare the extract, one part by weight of the chopped plant is placed in six parts of water at a temperature of 85°–105° F., and left for 24 hours at the temperature of the room; the liquid is then strained through cloth and the residue pressed out. It is then again mixed with three parts of water and after 24 hours the process

of straining and pressing is repeated; the extracts obtained in this way are mixed together and form the insecticide. A decoction of the root and other parts of *Bryonia alba* (white bryony) can be used against Aphids, etc. (one part by weight in three or four parts of water). To prepare an extract of *Conium maculatum* (hemlock), 100 parts by weight of fresh leaves with flowers and small stalks are cut into small pieces, mixed with five or six parts of water and ground in a mortar; the pulp obtained is then pressed out and again mixed with 15 parts of water; this is again ground and pressed out, the second liquid being added to the first. Extracts of the tropical species of aloes are also effective against various insects, as has been proved by experiment.

SCHREIBER (A. F.). **Растительные инсектисиды.** [Vegetable insecticides.]—« **Садоводъ.**» [*The Horticulturist*], *Rostov-on-Don*, no. 12, December 1915, pp. 903-912.

The good results obtained by some insecticides of vegetable origin [see also this *Review*, Ser. A, iii, pp. 340, 440, 441 and 486], such as a decoction of tomato leaves and stalks against the caterpillars of *Pieris brassicae*, are discussed. A decoction of leaves of *Veratrum album* or *V. nigrum* against pests of market-gardens is the only remedy used by the peasants in Transbaikal. Decoctions of *Datura stramonium*, *Petunia*, *Hyoscyamus niger*, *H. albus*, *H. major*, *Euphorbia biglandulosa* and *E. dendroides* are all recommended by Sprenger in "Die Gartenwelt" (1912). The author describes his own experiments with extracts of aloes, henbane (*Hyoscyamus niger*) and wormwood (*Artemisia absinthium*) in 1915. The extract of aloes is sold ready-made, but may be prepared by extracting the aloes in boiling water and adding molasses to make it adhesive. Spraying is carried out early in the morning, after the disappearance of dew, and again in the evening at sunset. Henbane was cut into pieces while in flower, dried and boiled in water till nearly all the water had evaporated; the decoction remaining was then strained through gauze, and for use, 1 lb. of the extract and 1 lb. of soft soap are dissolved in about six gallons of water. The decoction of wormwood was prepared in the same way, 1 lb. of it with 1½ lb. of soft soap being dissolved in about four gallons of water. Cabbage, salad-plants, turnips, bird-cherries, birch trees, etc., were sprayed against *Barathra* (*Mamestra*) *brassicae*, *Plutella maculipennis* (*cruciferarum*), *Phyllotreta* sp., and *Aphis* sp. The best results were obtained with the aloes against all these pests; wormwood had little effect on *Phyllotreta*, and the extract of henbane was effective only against Aphids. Extracts of tomatoes and hellebore were very effective against Aphids and various other market-garden pests, such as *B. brassicae*, *Plutella maculipennis*, *Pieris napi*, *P. brassicae*, *P. rapae*, and *Phyllotreta*. In order to prepare these extracts, the plants must be dried, cut into pieces, closely packed in a container and boiled in water, stirring and crushing the contents from time to time. After five or six hours, when all the water will have evaporated, the decoction is strained through gauze. It can be kept a long time in bottles which are well corked; for use, 1 lb. is dissolved in about six gallons of water; spraying should be done on sunny days and repeated after rain.

OSSIPOV (N.). **Способъ борьбы съ домашней молью. Семейство** "Tineidae." [A remedy against the house-moth. Family Tineidae.]—**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 12, December 1915, pp. 897-900.

Three species of Tineids are known under the name of house-moth in Russia, viz:—*Tineola biselliella*, Hummel, *Tinea* (*Trichophaga*) *tapetiella*, L., and *Tinea pellionella*, L. A short account is given of their life-history and of remedies for them, of which the most effective are the sewing up of articles in strong bags, frequent airing, etc., such measures as powdering with tobacco and naphthaline being of little use. A remedy applied with success by the native population of Bessarabia consists in keeping in all rooms, etc., bunches of *Melilotus officinalis*, the scent of which keeps the premises free from the moths. The author's own experiments with this plant proved completely successful and he suggests further investigations with it.

Состояніе озимыхъ всходовъ къ 1-му ноября 1915 года. [The state of winter-sown crops up to the 14th November 1915 in European Russia, Western Siberia and Central-Asia.]—**«Извѣстія Министерства Земледѣлія** (new title for **« Извѣст. Главн. Управл. З. и З.»** [*Bulletins of the Ministry of Agriculture* (new title for *Bulletins of the Central Board of Land Administration & Agriculture.*)], *Petrograd*, no. 47, 5th December 1915, pp. 1152-1155.

Only slight damage was done to crops by insect pests in European Russia during the autumn of 1915. Caterpillars of *Euxoa segetum* were reported from the governments of Central, South-western and Novorussia, and from those of Samara, Saratov, Penza, Livland and Perm, but they did not cause any substantial damage and disappeared with the arrival of frosts and rainy weather. In the south-eastern and some of the southern governments, small numbers of the Hessian fly (*Mayetiola destructor*) and of *Oscinella* (*Oscinis*) *frit* were observed. With few exceptions, no important insect pests were noticed in the provinces of western Siberia and Central Asia.

OL (I. A.). **О вредителѣ яблони.** [On a pest of apple-trees.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing & Market-gardening*], *Petrograd*, no. 48, 12th December 1915, p. 1260.

In reply to a subscriber, the author states that his apple trees are probably attacked by *Rhynchites coeruleus*, de G. The imagines of this pest are found in May and June on various fruit trees, including cherries, apples, plums, pears, apricots, etc., and also on service and bird-cherry trees. At the beginning of summer, the weevils injure leaf and flower buds; the females oviposit inside the shoots and gnawing at the stalk of the shoot cause the latter to hang or drop down. The larvae mature in four weeks and pupate at a depth of a few inches in the earth. Only one generation occurs during the summer. Shaking the weevils from the trees and the collecting of the shoots injured by the females are the remedies advised.

MALLY (C. W.). **Anhydrous liquid Hydrocyanic Acid for Fumigation Purposes.**—*South African Jl. Sci., Cape Town*, xii, no. 3, October 1915, pp. 95–96. [Received 29th December 1915.]

The usual method of fumigation for insect pests, i.e., by generating hydrocyanic acid gas from sodium and potassium cyanide and sulphuric acid, leaves much to be desired. The chemicals require care in preparation; there is danger of burning the tents round the trees by contact with acid, or the absorption of fumes given off during the generation of the gas may result in injury to the canvas. Anhydrous liquid hydrocyanic acid, readily produced at a low temperature, proved easy to work with, and on testing with various insects, was found to diffuse more quickly and to be more violent in its action than gas from a generator. Pieces of silk, muslin and canvas saturated with acid showed no injury after two weeks. This fact is of considerable practical importance. Field tests are being carried out.

JARVIS (E.). **Notes on Experiments for the Control of the Sugar-cane Beetle.**—*Queensland Agric. Jl., Brisbane*, iv, no. 5, November 1915, pp. 290–291.

Preliminary experiments on trapping adults of *Lepidiota albohirta*, by means of attractive odours gave negative results. It is, however, reasonable to assume that the movements of cane-beetles are determined by forces which probably exercise important influences on the flight of the adult female prior to oviposition. Remedial methods which have not yet been studied are (1) controlling oviposition by means of attractive ground traps, and (2) prevention of egg-laying by means of deterrents applied to the surface of the soil or injected into it.

FLETCHER (T. B.). **Bees and the fertilization of Coffee.**—*Dept. Agric., Madras*, iv, Bull. 69, 1915, 38 pp. 5 figs. [Received 28th December 1915.]

The question of the value of bees in coffee districts was raised at the Annual Meeting in 1911 of the United Planters' Association of Southern India, with particular reference to the regular destruction of these bees in certain districts, and a resolution was passed asking the Government to interfere to prevent such destruction and to regulate the methods of taking wild honey and wax. Instructions were accordingly given to the Government Entomologist to inquire into the matter. The principal species of bees found, were *Apis dorsata*, the large rock bee, *A. indica*, the Indian bee, and *A. florea*, the small bee. The flowering season of coffee is very short, only three or four days at the most, and the time for observation is thus very limited, but the question was sufficiently studied to show that bees are important agents in pollination and that, of the species named, the rock bee, *Apis dorsata*, is the one chiefly concerned, though other insects play a considerable part. The evidence collected pointed to a steady reduction of bees in the coffee districts in recent years, and this is attributed not only to systematic persecution of the bee-colonies for the sake of honey and wax, but also to the opening up of the coffee districts and the consequent reduction of suitable nesting-places.

Planters are urged to encourage bees on their estates, and if any attempt be made at bee-keeping, to employ *Apis indica*, as the habits of the other species render this almost impossible.

Incidentally it was found that the Jak Cercopid, *Cosmocarta relata*, was a very serious pest of the Jak tree in Coorg, and a Pyrrhocorid bug, *Odontopus nigricornis*, was found in hundreds in all stages on one estate feeding on the fallen fruits of various trees, chiefly *Ficus*, *Trewia*, etc.

IMMS (A. D.) & CHATTERJEE (N. C.). **On the Structure and Biology of *Tachardia lacca*, Kerr, with observations on certain insects predaceous or parasitic upon it.**—*Indian Forest Mem., Forest Zool. Ser., Calcutta*, iii, no. 1, 1915, 42 pp., 8 plates. [Received 28th December 1915.]

Tachardia lacca, Kerr (lac insect) has a wide distribution in India but is mainly confined to elevations below 1,500 feet. The trees and shrubs serving as food-plants exceed 90 species, but of these only a few yield lac in sufficient quantity to be commercially valuable. *T. lacca* is almost certainly viviparous and is double-brooded. The first generation of larvae emerges from the middle of June until the beginning of August, the date varying according to the food-plant, locality and climatic conditions. This generation gives rise to the second brood of larvae which emerge from the middle of October until the beginning of January. In both broods the larvae issue from the resinous incrustations of the female; this process is termed swarming and lasts from 10 days to 4½ weeks. It is exclusively during the swarming period that the insect spreads from one tree to another, high winds being the main distributing agency. A small number are probably carried by birds, and ants also are believed to be an important factor. On emergence, the larvae search for tender twigs. Owing to the fact that they attach themselves very closely together, the individual incrustations of lac which are secreted, become confluent and form thick excrescences on the twigs. The male insects emerge about one month after the fixation of the first brood larvae and from 3½ to 5 months after fixation of the second brood. The female remains in the cell throughout life. Young larvae appear from two to three months after the emergence of males. From the time of fixation onwards, *T. lacca* secretes honey-dew in considerable quantities. This substance forms a nutritive medium for certain fungi, belonging chiefly to the genera *Fumago* and *Capnodium*, and is attractive to one or more species of ants.

T. lacca appears to be one of the most extensively parasitised of all known COCCIDAE. Of the Lepidoptera, *Eublemma amabilis*, Moore, is the most destructive of all insects attacking lac. It has been bred from lac received from the Central Provinces, United Provinces and Bombay, and it is common in Bengal. The eggs are deposited in crevices of the lac incrustations; the resulting larvae devour both the lac and the Coccids within. Pupation takes place near the surface of the lac. There are at least two generations annually, possibly three in the hottest localities. The adults of the first generation emerge from June to August, those of the second from October to December or January. Owing to the great variability in the duration of the larval and pupal stages, the generations often overlap,

and adults may be bred out during the greater part of the year. *Hypatima* (*Blastobasis*) *pulverea*, Meyr., is common in forests and resembles *E. amabilis* in habits. The larvae, however, are not dependent upon living lac, since they have been found three months after the lac has been removed from the trees. Lepidopterous enemies of minor importance are *Eublemma cretacea*, Hmp., *E. coccidiphaga*, Hmp., *Blastobasis thelymorpha*, Meyr., *Tischeria ptarmica*, Meyr., and *Stathmopoda basiplectra*, Meyr.

Many Hymenopterous parasites and hyper-parasites have been reared from *T. lacca*. *Lissencyrtus troupi*, Cam., is abundant in the Siwalik and Bhandara forests. The eggs are deposited within the young *Tachardia*, which, however, are not killed until in a late stage of development. Pupation occurs within the host. Adults emerge throughout the year, but the hot weather brood is most severely attacked. Another Chalcid, *Brasema annulicaudis*, Cam., was bred from lac grown on *Butea frondosa*. It may possibly be a parasite of *E. amabilis* or *Hypatima pulverea* and therefore a hyperparasite of *T. lacca*. The same statement also applies to *Chalcis tachardiae*, Cam. *Pteromalus* sp., *Cyclopleura claripennis*, Cam., *Eurytoma pallidiscapus*, Cam., *Copidosoma* ? *clavicornis*, Cam., and *Hadrothrix purpurea*, Cam., are also recorded parasites. Among the beetle enemies are the Mycetophagid, *Berginus maindroni*, Grouv., abundant in the United and Central Provinces, devouring both the lac and the scales, the Cucujid, *Silvanopsis iyeri*, Grouv., *Cathartus advena*, Wlt., *Tribolium ferrugineum*, F. (feeding on the lac only), *Brachytarsus* sp., and a Cerambycid.

As the result of investigations, the authors have been led to the conclusion that no appreciable improvement in lac cultivation can be obtained until exhaustive experiments have been conducted with reference to the elimination of the insect enemies of *Tachardia*. Experiments have indicated that the pests cannot be eradicated by a complete removal of the lac from the trees after swarming. Evidence shows that many parasites emerge prior to swarming. Complete removal of the lac will, however, in all probability reduce the aggregate of the parasites. The method of scraping the lac from the trees and storing it in huts close by does not aid in reducing the number of parasites. Whether the parasites and predaceous enemies are able or not to feed on other COCCIDAE in the absence of *Tachardia* is unknown. The problem is one that should be kept in view in attempting to control the natural enemies of the lac insect.

ANDREWS (E. A.). **Notes on insect pests of green manures and shade trees. Part I.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, Part iii, 1915, pp. 57–62.

The following are injurious to green manure crops and shade trees in the tea-gardens of North-East India :—The blister beetle, *Cantharis hirticornis*, Haag, is very common in Assam, where it does a great deal of damage in vegetable gardens. The life-history of this beetle has not been worked out, but it is probably beneficial in its young stages, for the larvae of a closely allied species feed on the egg-masses of a grasshopper. *C. hirticornis* is recorded from Assam as eating the foliage of young plants of *Sesbania aculeata* (dhaincha). Catching with small nets is the best remedy. Lead arsenate may be sprayed

where there is no possibility of danger, otherwise, lead chromate should be used. The Arctiid, *Diacrisia obliqua*, Wlk., was found to attack *Glycine soya* (soy bean) and *Desmodium* sp. in Assam. Other crops which it is known to attack, are *Crotalaria juncea* (senn hemp) and *Arachis hypogaea* (ground-nut). The eggs are laid on the underside of the food-plant in batches and take about four days to hatch. The larval stage lasts about three weeks; pupation takes place in the ground and after 10 days the moth emerges, having completed its life cycle in about five weeks. It is easy to collect the young caterpillars when they are still gregarious. Lead chromate may be used as a spray. If the plants are badly attacked, they should be hoed up directly the caterpillars have descended to pupate, as this will destroy large numbers. The Pierid, *Catopsilia pyranthe*, L., defoliates *Cassia fistula* (sonaru trees) in Assam and also attacks *Sesbania* and probably other Leguminosae also. *C. fistula* is usually grown more for ornament than for shade, and spraying could only be effected by means of a power sprayer. Another Pierid butterfly, *Terias hecabe*, L., has been reported from the Duars and Assam on *Sesbania aculeata*, which, in a bad attack, may be completely defoliated; *Albizzia stipulata* (sau tree) was also defoliated. The control of this pest is a difficult matter. In the case of *S. aculeata*, lead arsenate or lead chromate might be applied, if it can be done without spraying the tea also, but for *A. stipulata* a power sprayer would be necessary. Fortunately the attacks of this pest seem to be sporadic. The Pentatomid bug, *Coptosoma nazirae*, Atk., is found in large numbers on *Tephrosia candida* (boga medeloa). The only remedy, should the pest become serious, would be hand collection, insecticides being of little or no value. The Coccid, *Eriochiton theae*, Green, has long been known as a pest of tea, but recently specimens have been received from the Western Duars on *Erythrina indica* (dadap) and from the Eastern Duars on *Cajanus indicus* (Arhar dal). In both cases the pest commenced on the green manure plant and later attacked tea. When it occurs on *E. indica*, the caustic soda spray advised against scales on tea [see this *Review*, Ser. A, iii, p. 490] may be used, but in the case of *C. indicus*, the treatment would have to be confined to spraying with resin solution.

ANDREWS (E. A.). **A swarm of locusts in the Darjeeling and Terai districts.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, Part iii, 1915, pp. 63-67.

In July 1915, the author witnessed an invasion of the Darjeeling and Terai districts by *Schistocerca* (*Acridium*) *peregrina*, Oliv. Even in cases where the locusts settled everywhere, the injury done to tea was very small. The bulk of the damage to tea appeared to be due to the enormous amount of excreta on the leaves. Other plants were however stripped more or less completely. The home of this locust is in the sandy deserts to the west of Afghanistan and Baluchistan, whence it periodically swarms over India. The consensus of opinion amongst the planters of the Darjeeling Terai seemed to be that the last swarm to invade that district appeared in 1891, although one or two stated that there had been a small swarm since. According to Stebbing, a swarm spread as far east as the Brahmaputra river in 1901.

ANDREWS (E. A.). **Entomologist's tour in the Darjeeling and Terai districts.**—*Qrtly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* Part iii, 1915, pp. 75–78.

During a tour in the Darjeeling and Terai districts, large numbers of young specimens of a Reduviid bug belonging to the genus *Harpactor* were observed to be brought in by the children who were catching tea mosquitos (*Helopeltis*). The collection of these predators should be prevented. In one garden the number of *Harpactor* reached, on occasion, 25 per cent. of the whole catch. Around Lebong, the dadap trees were found to be attacked by an insect closely resembling *Empoasca flavescens* (tea green-fly), but which closer examination showed to be more nearly allied to *E. notata.* The insects seem to be gregarious, and the undersides of the leaves were covered with them in all stages. The leaf is attacked from the under surface and becomes covered with pale blotches, which turn yellow until eventually the whole leaf dies back. The young shoots and leaves also tend to become stunted. Spraying from below with kerosene emulsion or potassium sulphide should easily control this pest.

ASSMUTH (J.). **Indian Wood-Destroying "White Ants".**—*Qrtly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* Part iii, 1915, pp. 79–80.—[Abstract from *Jl. Bombay Nat. Hist. Soc., London,* xxiii, no. 4, 1915, pp. 690–694.]

As a result of investigations carried out in the provinces of Bengal, Behar, Bombay, and Madras, the termites doing damage to the wood of buildings in British India are found to belong to three species, *Leucotermes indicola, Coptotermes heimi,* and *Odontotermes feae,* though it seems possible that in Sind a species of *Microtermes* has also acquired the habit. Wood-destroying termites were not found in the Ghats of South Canara and Mysore at a higher level than 3,000–4,000 feet above sea-level. Termites do not appear to start an attack on healthy trees, though this is sometimes thought to be the case, owing to true ants being mistaken for them.

WATERSTON (J.). **Notes on African Chalcidoidea (III).**—*Bull. Entom. Research, London,* vi, no. 3, December 1915, pp. 231–247, 8 figs.

The following species are described :—*Tetrastichus atriclavus,* sp. n., from Southern Nigeria; *T. mauripennis,* sp. n., from Nyasaland; *T. sculpturatus,* sp. n., bred from the larva of a butterfly, *Neptis agatha,* from Uganda and *T. balteatus,* sp. n., bred from the pupa of a Lymantriid moth from Nyasaland. *Syntomosphyrum phaeosoma,* Wtrst., has been bred from *Sylepta derogata* (cotton leaf-roller) in Nyasaland.

WILLIAMS (C. B.). **A new Thrips damaging Coffee in British East Africa.**—*Bull. Entom. Research, London,* vi, no. 3, December 1915, pp. 269–272, 1 fig.

Diarthrothrips coffeae, gen. et sp. n., is described. This thrips has caused serious damage to the leaves of coffee in several districts of British East Africa. Amongst the larvae of *D. coffeae* was a single larva of a thrips belonging to the family AEOLOTHRIPIDAE. The known larvae of this family are largely, if not entirely, predaceous on other thrips and it is probable that this species was feeding on the larvae of *D. coffeae.*

Cleare (L. D.). **A Butterfly injurious to Coconut Palms in British Guiana.**—*Bull. Entom. Research, London*, vi, no. 3, December 1915, pp. 273–278, 1 fig., 3 plates.

During the year 1914, coconut palms in Georgetown were attacked by the larvae of *Brassolis sophorae*, L. (coconut butterfly). From previous records, it would appear that this insect occurs in injurious numbers at intervals of about five years. It is probably distributed throughout the coast lands of British Guiana and has also been reported from Dutch Guiana, Trinidad and southward to South Brazil. In addition to coconut, *Oreodoxa oleracea* (cabbage palm) is also attacked. The eggs are laid in masses of from 100 to 150 on the stem and underside of the leaves of the host. The larvae usually emerge simultaneously from the mass. They feed almost entirely at night on the green parts of the leaves, resting by days in pockets formed by binding the leaves together. Several hundred larvae collect in each such nest. The duration of this stage is about four weeks. The pupal period lasts 14 days. From the apparent point of origin, south-west of Georgetown, the attack spread to the north-east in opposition to the prevailing winds. It was noticeable that blocks in the midst of affected areas remained untouched, as also did palms near the sea. A count of dead trees made in September showed that 5 per cent. had succumbed. The insect has several natural enemies, including a bird, *Pitangus sulphuratus* (kiskadee), which feeds on the adults, several egg-parasites, and a parasite of the pupa, *Chalcis annulata*, F. The habit of the larvae of living in nests during the day offers the best means of controlling this pest, as the nest can be easily removed and destroyed.

Howlett (F. M.). **Chemical Reactions of Fruit-flies.**—*Bull. Entom. Research, London*, vi, no. 3, December 1915, pp. 297–305, 4 plates.

Experiments carried out by the author at Pusa, Bengal, in 1912 showed that certain essential oils were attractive to males of *Dacus* (*Bactrocera*) *zonatus*, Saund., and *D. diversus*, Coq. The flies perceived the smell of small quantities of citronella mixed with almost any other substance. In the absence of citronella no definite attraction was noted, except in the following cases:—(1) one sample of oil of eucalyptus; (2) a mixture of clove oil, coconut oil and kerosene; (3) a mixture of clove oil and eucalyptol. Investigations were resumed in March 1913. Three of the commoner species of fruit-flies, *D. diversus*, *D. ferrugineus* and *D. zonatus*, normally breed in (1) the anthers of Cucurbitaceae, (2) the fruits of Solanaceae and mango, and (3) peach, guava, mango and other fruits, respectively. Citronella contains methyl-eugenol and probably eugenol and iso-eugenol; bay oil contains methyl-eugenol and eugenol, while clove oil consists of from 70 to 90 per cent. of eugenol. It was found that *D. diversus* was most strongly attracted by iso-eugenol, *D. zonatus* by methyl-eugenol, and *D. ferrugineus* by methyl- and iso-eugenol. The odours of these substances have not yet been identified with those of the plants which form the normal breeding-places, but only the male flies have been found to be attracted to mango, papaya, a Cycad, and *Colocasia*, plants with a very characteristic scent similar to that of eugenol derivatives. The males give the impression that they might visit these plants for food, since they suck the surface of the flowers. One species, perhaps *D. ferrugineus*,

was bred from a *Eugenia* at Bangalore. Two other species of fruit-flies, *D. caudatus*, breeding in fruits of Cucurbitaceae, and an unidentified species, were captured by means of eugenol and an amylvanillin solution respectively. No substance attractive to the males of *D. cucurbitae* was found.

The original view of the author that these odours were direct sexual guides emitted by the females is as yet unproved. Crushed females proved quite unattractive to the males. On the other hand, the scent may not be emitted by the female, but may be termed an indirect sexual guide to the plants where the females normally breed. It may also be associated with food, but this would involve the assumption that the feeding-habits of the males differed from those of the females.

WATERSTON (J.). *Ooencyrtus pacificus*, **a new egg parasite from Fiji (Hym.).**—*Bull. Entom. Research, London*, vi, no. 3, December 1915, pp. 307–310, 1 fig.

A description is given of *Ooencyrtus pacificus*, sp. n., bred from the eggs of *Brachyplatys pacificus*, Dall. (bean bug), in Fiji.

WOODWORTH (C. W.). **Theory of Toxicity.**—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, pp. 509-512, 1 plate.

A study of the theory and practice of fumigation has led to certain results which are represented graphically. Each curve indicates the percentages of the insect eggs which failed to hatch after treatment in a certain density of gas for varying intervals of time. Seven theoretical curves are drawn which correspond closely with the experimental data and show that complex relationships exist. The toxic phases are represented by the following curves:—(1) the preliminary curve, in which the toxicity is directly proportional to an increasing geometric series of time intervals; (2) the deviation line or centre of a zone in which the toxicity curves diverge, inversely proportional to the toxicity during the preliminary period; (3) the acute curve, representing a different physiological action of the cyanide, possibly directly on the nerve centres; (4) the compromise curve, lying almost midway between the acute and stimulation curves; (5) the stimulation curve, indicating the benign effect of cyanide; (6) the critical line, representing a second physiological crisis, measuring the culmination of the violent effect of the poison and the beginning of recovery.

The theory of toxicity put forward by this study includes the following propositions:—(1) there are three separate effects produced by a poison, depending on its concentration; (2) a line of deviation exists beyond which their characteristics become most evident; (3) acute poisoning reaches a maximum after which the death-rate rapidly declines; (4) these phenomena exhibit a series of definite mathematical relationships.

CRAIGHEAD (F. C.). **A New Mixture for controlling Wood-boring Insects—Sodium Arsenate-Kerosene Emulsion.**—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, p. 513.

During the summer of 1915, a mixture of kerosene emulsion and sodium arsenate was tested to ascertain its value in controlling wood-boring insects such as the Longicorn beetles, *Goes* sp. and *Cyllene picta*

(painted hickory borer). A 5 to 10 per cent. arsenical solution was mixed with the water used in making the emulsion, but it is probable that a more dilute solution could be used. The results were very successful, the penetrating properties of the kerosene being fully retained. Tests made on the mines of *Goes* in living wood showed that by painting the holes where the boring dust is exuded, the mixture quickly ascends through the frass and along the sides of the burrow, killing the larvae in a few days. Similar results were obtained in hickory-logs infested with *C. picta*. The mixture has not been tested against borers in timber for buildings but will doubtless give good results where the lumber is not exposed to severe weather conditions.

KNIGHT (H. H.). **Notes on** ***Ichneumon laetus*****, Brullé.**—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, pp. 514–515, 1 plate.

Males of *Ichneumon laetus*, Brullé, were reared during the summer of 1914 from the pupae of *Cirphis* (*Leucania*) *unipuncta*, Haworth. Emergence began on 15th August and continued for a week. On 24th August females of *I. funestus*, Cresson, and *I. canadensis*, Cresson, began to emerge. Pairing between a male of *I. laetus* and a female of *I. funestus* was observed and breeding experiments showed that *I. canadensis* and *I. funestus* are the females of *I. laetus*, the last name having the priority. Males were again collected during December in decaying logs and hibernating females were found about 8 inches below the surface of a gravel bank during March.

SELL (R. A.). **Some Notes on the Western Twelve-spotted and the Western Striped Cucumber Beetles.**—*Jl. Econ. Entom, Concord*, viii, no. 6, December 1915, pp. 515–520.

Diabrotica soror, Lec. (western twelve-spotted beetle or western flower beetle), feeds upon a variety of plants, the choice depending upon locality, season and stage in the life-history. In the vicinity of Berkeley, California, it feeds on more than 500 varieties of plants and is harmful to at least 100 of these. Injury to cultivated flowers is very noticeable, since petals and essential organs are attacked. A study of the feeding habits shows that the insect must become adapted to a change of food. Twenty-five beetles which had been eating beet-leaves were fed on potato tops. Two of these died, the remainder becoming accustomed to the change in four days. Beet leaves were then added, but the potato tops were preferred. When the latter were removed, the insects fasted for one day and then resumed the original food. Under certain conditions, this species would eat some part of the flower or fruit of every plant upon which it was observed. Occasionally a beetle was found in a colony of Aphids. Field experiments with marked insects seemed to show that there was a period of comparative rest, followed by one of great activity. Each of these periods must have a definite relation to a stage in the life-history. *Celatoria diabroticae*, Shim., a Tachinid enemy of *D. soror*, was not common near Berkeley. An unidentified spider killed a few beetles. The birds observed feeding on the insects were the purple finch, bushtit, linnet and canon wren. Before pairing, the females

either fly or attempt to conceal themselves on the ground. The eggs are adapted to moist soil and the surface of the growing plant. Experiments on the control of the insect showed that lead arsenate spray (1 oz. to 1 gal. water) killed less than 9 per cent., but almost relieved the plants from attack for three days. Bordeaux mixture was not so effective as a repellent.

D. trivittata, Mann. (western striped cucumber beetle) is found with *D. soror* on pumpkins, cucumbers, squashes, etc., but is of small importance. It differs from *D. soror* in being a more general feeder and in having two generations annually. The larvae are sometimes destructive to cucumbers. The eggs are deposited 2 inches below the surface of the soil on the tap root of the plant. Upon hatching, the larvae work upwards on the root, and appear above the surface in two or three days. The edges of the leaves near the roots turn white and the whole plant withers and may ultimately die. Tobacco extract, one teaspoonful to a gallon of water, is a successful remedy.

MATHESON (R.). **Experiments in the Control of the Poplar and Willow Borer** (*Cryptorrhynchus lapathi*, **Linn.**).—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, pp. 522–525, 2 tables.

Cryptorrhynchus lapathi, L., is an important pest in nurseries in New York State and also causes serious damage to ornamental poplars and willows. The eggs are deposited in two- or three-year-old nursery plants and are laid exclusively in the corky portions of the tree. They are found most commonly near buds and branches or in growths caused by pruning. Eggs laid in August, September and October hatch during the same months. The young larvae hibernate in small chambers just below the surface of the outer bark. Feeding recommences in early spring, when the cambium is attacked. In late June they bore into the heartwood, forming pupal cells. Pupation takes place in July and adults begin to emerge in late July and August. The weevils feed for a short time before oviposition begins.

Early observations made by the author led him to the conclusion that this insect could be destroyed by some contact spray applied to the trunks of the trees in autumn after the leaves had fallen, or in spring before the larvae had begun feeding actively. During March 1914, badly-infested nursery trees were sprayed from the ground up to the young growth with scalecide of varying strengths, carbolineum and carbolineum emulsion. The latter was prepared from 1 lb. sodium carbonate, 1 qt. hot water, and 1 qt. carbolineum avenarius. The trees were examined on 14th May 1914. No ill effects on the growth could be observed. In the controls the larvae were abundant. Plants treated with scalecide showed as high an infestation as the control. In those sprayed with carbolineum, either pure or as emulsion, no trace of infestation could be found. Later examination on 18th June confirmed the previous observations. During the autumn of 1914 and the spring of 1915, experiments with kerosene emulsion, carbolineum and carbolineum emulsion were carried out on a larger scale. Examination in June showed that the area as a whole was severely infested, but that the rows treated with carbolineum or carbolineum emulsion were free from borers. Kerosene emulsion applied pure in autumn seemed to have had a slight effect.

Ball (E. D.). Estimating the number of Grasshoppers.—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, pp. 525–527.

In estimating the number of eggs laid by a swarm of *Camnula pellucida*, the approximate area infested was determined after disking the breeding ground so that the eggs appeared on the surface. The heavily infested portion was found to contain, on an average, 175 eggs per square inch. Young hoppers begin to migrate as soon as hatched, always travelling towards the sun. In estimating the numbers in one of the smaller migrating swarms, the central part of about 320 acres was found to yield an average of 1 per square inch. Around this centre was an average of from 10 to 15 per square foot. The swarms were caught in balloon catchers, from 400 to 800 lb. being captured daily with each trap.

Webster (F. M.). Some Developments in Grasshopper Control.—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, pp. 527–535, 1 fig.

Periodical outbreaks of several species of grasshoppers in the Merrimac and Connecticut River valleys in New England have occurred for the past 40 years and at no time have these outbreaks been satisfactorily controlled. The species involved are *Melanoplus atlantis*, *M. bivittatus*, *M. minor* and *Camnula pellucida*. Investigations were carried out during the spring and summer of 1915 to determine the possibility of controlling the insects. It was found that the young grasshoppers were more difficult to kill with poison baits than the adults. This difficulty was eliminated to some extent by doubling the amount of fruit in the poison-bran mixture and adding that ordinarily used in this bait to the Criddle mixture. It was discovered later that dry bait was not attractive to the grasshoppers; consequently, baits were placed in the fields before sunrise. With the poison-bran about 95 per cent., and with Criddle mixture 80 per cent. of the adults were killed. Experiments in Florida, where unsatisfactory results had been reported, showed that the bran-bait, if properly prepared and applied, would be effective in destroying the grasshoppers. In California, where *M. differentialis*, *M. uniformis*, *M. destructor* and *C. pellucida* were involved, six lemons were used for each 25 lb. of bran, with 2 qts. syrup and 3 gals. water. Lucerne meal proved of equal value to bran. An attempt to control grasshoppers by these poisons at Tempe, Arizona, was unsuccessful. When, later, sorghum molasses was substituted for the ordinary molasses generally used, the bait was found to be effective. The use of a hopperdozer may be profitable when it is desirable to control the insects immediately [see this *Review*, Ser. A, iii, p. 298]. In New Mexico, methods of shallow cultivation have been carried out during autumn and winter to destroy the eggs. Waste land in the North could be similarly treated in autumn if thorough co-operative measures were undertaken by farmers. It is probable that, were this carried out, serious attacks of grasshoppers would not be experienced in any part of the United States.

PARROTT (P. J.), GLOYER (W. O.) & FULTON (B. B.). **Some Studies on the Snowy Tree-Cricket with Reference to an Apple Bark Disease.**—*Jl. Econ. Entom., Concord*, viii, no. 6. December 1915, pp. 535–541.

Oecanthus niveus (snowy tree-cricket) is connected with the spread of a bark disease of apple, due to a fungus, *Leptosphaeria coniothyrium*, Sacc. The wounds produced in the bark by the insect are discoloured or dead, while the bark within the area of infection is slightly depressed and may be separated from the sound bark by a crack. In more advanced stages the cracks widen and afford shelter for woolly aphis [*Eriosoma lanigerum*]. In April or May a gummy, reddish-coloured fluid is exuded from the punctures. This fungus has previously been recorded on apples and roses at Washington, D.C., and on raspberries in New York. In raspberries, the fruiting canes are chiefly injured. According to Clinton, infection occurs in wounds made by the removal of branches, by the oviposition of *O. niveus*, etc. The facts that the blight is abundant on raspberries and that, while the tree-crickets occur in great numbers on raspberries, they prefer apple wood for oviposition, afford evidence that these insects are concerned in infecting apple trees with the disease. Tree-crickets are omnivorous in habit. In the early stages, the food consists of Aphids, leaf-hoppers, Tingitid bugs and scale-insects; when mature, they feed on the floral parts of various plants, on leaves, fruit and fungi present in bark and decaying vegetation. The majority of eggs of *O. niveus* have been found in apple, plum, cherry and elm. In the apple, deposition of eggs on the smaller branches occurs near the thickened bark at the bases of the twigs; in the raspberry, the eggs are inserted at the sides of the buds in the fleshy parts of the axils of the leaves. Infection of apple bark might take place as the result (1) of wounds produced by the gnawing of the bark by the female before oviposition; (2) of the adhesive substance discharged at oviposition, which serves to collect and retain the spores; (3) of the introduction of spores into the oviposition wounds on account of the habit of the insect of closing the wounds with its excreta.

Experiments to determine the effect of the digestive processes of the insects upon the vitality of the fungus spores gave the following results:—(1) The crickets fed readily on diseased areas of apple and raspberry cane, even when foliage and Aphids were supplied. (2) When crickets were starved for two days before feeding, spores of various fungi passed through the digestive tract in 6½ hours. (3) When crickets were allowed to feed normally before the tests, spores of various fungi, including *Sphaeropsis malorum* (New York apple canker) and *Nummularia discreta* (blister canker), were found in the excreta four days after diseased wood ceased to be given as food. (4) Spores of *S. malorum* and of *Coprinus micacious* [*sic*] showed a high rate of germination after passing through the digestive tract. (5) Attempts to establish *S. malorum*, the *Coniothyrium* canker and *Sclerotinia fructigena* (brown rot) in peaches and apples proved failures, except for a slight infection by *Coniothyrium* in one case.

LEONARD (M. D.) & CROSBY (C. R.). **A New Species of *Gonatocerus* (Mymaridae) parasitic on the eggs of a New Species of *Idiocerus* (Bythoscopidae) feeding on Poplar.**—*Jl. Econ. Entom., Concord*, viii, no. 6, December 1915, pp. 541–546, 2 plates.

Idiocerus gemmisimulans, sp. n., was reared from eggs found on poplar at Ithaca, N.Y. The eggs began to hatch on 19th April and adults were obtained on 14th May. A description of this Jassid is given. Until the fourth stage, the nymphs remain feeding on the leaves. Later they are found on the smaller twigs, resting with the head directed towards the base of the branch. In this position they closely resemble, in form and colour, the buds of the poplar. On 20th May, parasites were observed emerging from the eggs of *I. gemmisimulans* through a hole in the bark overlying the egg-clusters. These also proved to be a new species and are described as *Gonatocerus ovicenatus*.

Scientific Notes.—*Jl. Econ. Entom., Concord,* viii, no. 6, December 1915, pp. 549–554.

Cyllene robiniae, Forst., and *Crioceris asparagi*, L., were observed for the first time at Boulder, Cal., in September and October 1915. *Eriococcus* sp. was found on twigs of *Gaylussacia* at Hammond, N.Y. *Rhabdophaga aceris*, Shim. (soft maple leaf midge) was abundant near Albany and caused material injury in the case of small trees. The insect becomes established in the unfolding leaves, preventing their normal expansion, and in a serious infestation one or more lobes of the affected leaves may curl and die. The larvae occur mostly on the tip of the leaf, along the veins. Pupation takes place on the leaf. Infestation is favoured by conditions producing a rapid, succulent growth. Spraying with a contact insecticide is the best method of controlling this midge. A weevil, *Eudiagogus rosenschoeldi*, Fhs., was found in August 1913 injuring the nodules on the roots of *Sesbania macrocarpa*. The larvae probably also feed on the roots as well. Adults of this weevil were taken during the winter from hibernating places in clumps of *Andropogon virginicus*. There is probably one generation annually. It has also been recorded on *Cassia occidentalis*, *C. obtusifolia*, *Sesbania vesicaria*, and *Xanthoxylum clavaherculis*. With the draining of swamps and the decrease in its native hosts, the insect may become a pest, especially upon introduced forage plants. Certain unusual nursery insects are recorded. *Pseudococcus kraunhiae*, Kuwana, was found at Rutherford, N.J., on *Taxus cuspidata brevifolia*, where it had evidently been established several years. Some of the infested plants were originally imported from Japan. *Antonina crawi*, Ckll. (cottony bamboo scale) occurred at Riverton, N.J., on *Bambusa henonis* and *B. aurea*, to which considerable damage was caused by the presence of large colonies in the leaf-axils. *Trioza magnoliae*, Ashm., was abundant on bay trees at Rutherford, resulting in the deformation of the leaves. Tobacco extract and whale-oil soap were effective in controlling this Psyllid. The sawfly, *Pteronus hudsoni*, Marl., was observed for the first time in New Jersey feeding on *Populus canadensis* during August 1915. *Otiorrhynchus sulcatus*, F., has recently become a pest on rhododendrons and *Taxus* in several nurseries. This weevil has been introduced from Europe, where the food-plants include peaches,

grapes, *Taxus* and rhododendrons. It occurs in light sandy or clay soils, in hot-houses and manure heaps. The most serious damage is caused by the larvae. Normally, the mature larva hibernates and pupates in the following spring, but young larvae may hibernate and resume feeding in the spring. Adults emerge from the soil during May, June and July and oviposit from June to August. The eggs are laid in the ground. Larvae hatch in about two weeks, feed on roots until winter, then hibernate and pupate in the soil during April and May. Trapping the adults by means of bundles of moss, straw, etc., placed on the ground in the evening, is the most effective control method.

Investigations in connection with non-migratory Aphids and the spread of fire-blight showed that among Aphids on apple there is a continual shifting, independent of enemies, and interrupted only by a cool period. Fire blight is checked by a fall in temperature, but during a favourable period, may be spread by Aphids and leaf-hoppers of a shifting species. Aphids are not sedentary with reference to a single shoot. Definite movements were observed which may help to explain the activity of blight in trees that have been thoroughly pruned. A study of fertile stem-mothers and autumn females shows that some mothers may deposit young in a very small area, while others may move for a considerable distance. These facts support the view that Aphids are among the chief carriers of fire-blight.

Observations made near Madison on the habits of the English sparrow tend to strengthen the supposition that this bird is the chief carrier of the San José scale [*Aspidiotus perniciosus*] in closely settled, residential districts.

FELT (E. P.). **Thirtieth Report of the State Entomologist, 1914.**—*New York State Museum, Albany, N.Y.*, Bull. no. 180, 1st January 1916, pp. 336, 101 figs., 19 plates.

The year ending 30th September 1914 is covered by this report.

Fruit-tree pests :—*Malacosoma americana*, F. (apple tent caterpillar) was a general, and in some localities, a serious pest, but was scarce in well-sprayed orchards. An outbreak of *Erannis tiliaria*, Harr. (ten-lined inch worm) was reported as very destructive to both orchard and woodland trees in Ulster county. It was associated with the spring canker worm, *Palaeacrita vernata*, in defoliating maple and elm trees near the village of Greenwich. There was a considerable flight of this moth in Albany on 21st October, in association with the cotton moth, *Alabama argillacea*, Hb., and it was probably equally abundant at Kingston. Lead arsenate (4 lb. to 50 U.S. gals. of water) is an efficient spray. Adults of *Xylina antennata*, Walk. (green fruit worm) were received in March and April from Kingston and indications pointed to a narrow escape from an outbreak upon soft maples comparable to that of 1898, or the more extended defoliation of 1911. In the latter part of May, this pest was unusually abundant in apple orchards and on three-year-old pear trees. *Taeniothrips* (*Euthrips*) *pyri*, Dan. (pear thrips) was very injurious locally in the Hudson valley. Seckle and Bartlett pears were badly injured, while Kiefers were practically free from attack. It was stated that the cold weather had checked growth and favoured the attacks of thrips. The control previously advised [see this *Review*, Ser. A, iii, p. 473] was successful.

Contarinia pyrivora, Riley (pear midge) appears to thrive on the heavy lime soil in southern Albany county and is said to have caused considerable losses. *Psylla pyricola*, Forst. (pear psylla) caused an unusual amount of injury in some Hudson valley orchards. In spraying with winter strength lime-sulphur or with miscible oil, the important point is to delay the application until most of the eggs of this pest have been laid, i.e., just before the opening of the blossom buds. Practical tests showed that a midsummer spray of Black-leaf 40, using ¾ U.S. pint to 100 U.S. gallons of water and 4 to 8 lb. of soap, would severely check the insect, if not entirely destroy it. *Lygidea mendax*, Reut. (lined red bug) is the species responsible for most of the red bug injury in the Hudson valley. Black-leaf 40 is one of the most efficient controls. With reference to *Paracalocoris scrupeus*, Say (banded grape bug), Mr. L. F. Strickland considers that the dropping of immature grapes may have been caused by a weak pollination rather than as a result of insect injury. The Jassid, *Idiocerus maculipennis*, Fitch, was active and abundant on apple trees at Arlington in May, but did not seem to cause any particular injury. Observations on the San José scale [*Aspidiotus perniciosus*] and its parasites were continued; for the present it is recommended that spraying with lime-sulphur be continued without regard to parasites. The most efficient of the latter is the recently discovered *Prospaltella perniciosi*, Tower, which is widely distributed in certain parts of the State.

Grass and garden insects:—*Crambus luteolellus*, Clem. (grass webworm) has been complained of. An almost unprecedented grasshopper outbreak occurred in the summer, mainly in the sandy areas bordering the Adirondacks. Poison baits proved very effective. *Melanoplus atlantis*, Riley, was by far the most destructive species. *M. femur-rubrum*, De G., *M. femoratus*, Burm., *Camnula pellucida*, Scudd. and *Dissosteira carolina*, L., also occurred. A yellow field ant was reported as injuring recently planted maize. An examination on 16th July showed that the kernels had been attacked here and there by a small ant, presumed to be *Solenopsis debilis*, Mayr. *Pomphopoea sayi*, Lec. (Say's blister beetle) was unusually abundant and injurious in the vicinity of Albany in May and June. The grubs feed on grasshopper eggs and it is probable that this species is on the whole decidedly beneficial. Jarring or smoking may be employed to drive the beetles away from valuable fruit trees. The Pentatomid, *Chlorochroa uhleri*, Stål (juniper plant bug) was stated to be present in unprecedented abundance in Schenectady county and to be causing serious injury. Sunflower seeds were practically destroyed. Green maize, small peas in the pod, tomatoes, currants and blackberries also suffered. *Macronoctua onusta*, Grote. (iris borer) worked havoc in an iris bed at Catskill. The outbreak of *Cirphis* (*Heliophila*) *unipuncta*, Haw. (army worm) approached in severity that of 1896. Poison baits, similar to those used against grasshoppers, proved useful. The rearing of a rather scarce Asilid fly, *Promachus fitchii*, O. S., was an interesting development in the study of white grubs and June beetles. This beneficial robber-fly was unusually abundant in the summer at Nassau.

Ornamental and shade tree pests:—*Vespa crabro*, L. (European hornet) has become well established in southern New York and throughout New Jersey and has attracted attention through gnawing off the bark from the small branches of various trees, especially birches.

These insects are probably more beneficial than injurious. The more valuable trees might be protected with a lead arsenate spray. *Galerucella luteola*, Müll. (elm leaf beetle) continued to be a serious pest of elms, particularly the European varieties. A study of climatic conditions revealed an interesting correlation between arrest in the development of this insect and unseasonable cold weather. Earlier studies show that under normal conditions, oviposition by *G. luteola* begins in the latter part of May and continues, through June, being at its height in the middle of the month. The month of June was therefore divided into three ten-day periods, and the maximum, minimum and effective temperatures were tabulated from 1905 to 1914. These tabulations are given in full, and in conjunction with the tentative conclusions advanced, give an approximate basis for determining the probability of serious injury locally before the brood has developed to such an extent as to damage the trees materially. In May, a fair-sized colony of *Lymantria* (*Porthetria*) *dispar*, L. (gipsy moth) was discovered in Westchester county. The control measures adopted proved efficient, though as yet extermination cannot be definitely said to have been secured. A scattered infestation of *Euproctis chrysorrhoea*, L. (brown tail moth) was discovered on Fisher's island and the eastern end of Long Island; the pest had very probably drifted with the winds from the adjacent mainland of Connecticut. The Jassid, *Alebra albostriella*, Fall. (Norway maple leaf hopper) caused an unexpected and severe injury to Norway maple at Newburgh, N.Y. *Chionaspis pinifoliae*, Fitch (pine leaf scale) was again reported. One lot of material was heavily infested by Chalcid parasites, especially *Aspidiotiphagus citrinus*, Craw.; smaller numbers of *Aphelinus mytilaspidis*, Le B., were obtained. Another species, *Perrissopterus pulchellus*, How., has also been reared from this pine scale. *Leucaspis japonica*, Ckll., infested Norway maples at Stamford, Conn. Other scales noticed were *Physokermes piceae*, Schr. (spruce bud scale) and *Phenacoccus acericola*, King (false maple scale). *Tetraleurodes mori*, Quaint. (mulberry white fly) was observed on *Kalmia latifolia* (mountain laurel).

Forest tree pests:—The season of 1914 was marked by an extension of the ravages of *Malacosoma disstria*, Hb. (forest tent caterpillar). The hickory bark beetle [*Scolytus quadrispinosus*, Say], *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (European pine shoot moth), and *Monarthropalpus buxi*, Lab. (box leaf midge) also occurred. *Tortrix fumiferana*, Clem. (spruce bud moth) was reported upon ornamental spruces; in one instance, at least, the blue spruce was attacked. Early spraying with arsenate of lead, 3 lb. to 50 U.S. gals. of water, is the most promising method of checking this insect. *Cacoecia* (*Archips*) *cerasivorana*, Fitch, was unusually abundant in the latter part of June in southern Rensselaer and northern Columbia counties. This leaf-feeder confines itself to chokeberry and is therefore of no economic importance. *Elaphidion villosum*, F. (maple and oak twig pruner) was unusually abundant along the Hudson valley and numerous reports of injury were received from the vicinity of New York City. *Tibicen septemdecim*, Linn. (periodical cicada) causes injury by oviposition; a case was reported where badly affected trees were much stunted.

Miscellaneous pests:—*Isosoma orchidearum*, Westw., was found in orchid bulbs from a conservatory in Westchester county. This European insect was first discovered in the United States in 1889 at Natick, Mass., and apparently did not again attract notice until the above occasion. The plants should be closely watched and infested parts should be burnt before the larvae can mature. Other insects noticed were the Pyralid, *Pionea* (*Phlyctaenia*) *terrealis*, Treits., and *Tetranychus telarius*, L. (red spider).

HARTMANN (F. T.). **List of the Coccidae in the Collection of the New York State Museum.**—*Thirtieth Rept. State Entomologist 1914, New York State Museum, Albany, N.Y.*, Bull. no. 180, 1st January 1916, pp. 92–109.

This list includes the 173 species of COCCIDAE in the New York State Museum; of these, 68 are found in New York State, 41 have been received in exchange from Japan and the others are from widely separated places in the United States.

SAVASTANO (L.). **Le invasioni di bruchi nei nocciuoleti del Messinese.** [The invasions of grubs in the hazel woods of the Messina district.]—*R. Staz. Speriment. Agrum. Fruttic., Acireale*, Boll. no. 19, October 1915. 16 pp.

Grub infestation in the hazel-woods of the Messina district has been observed for at least a century; the continual extension of these woods has caused the pests to multiply until the hazel-nut crop is now seriously menaced. In the area of San Piero Patti, three species of Lepidopterous larvae are chiefly represented, but they may not have been predominant there in the past, nor is it certain that they are so at present in other areas. The larvae usually pupate in the ground. Direct control is required; hand collection of the larvae and spraying with 1 per cent. lead arsenate are the methods recommended. Up to the present no cultural care has been given to the plantations, which are more in the nature of woods than of orchards. In Campania, hazel-woods more nearly resemble orchards, and are hoed every year; this hoeing destroys most of the larvae in the ground. *Balaninus pellitus*, Boh., and sometimes *B. elephas*, Gyll., occur in Sicily and hoeing would also destroy individuals of these species hibernating in the ground. At San Piero Patti, some woods were found to be infested with the weevils, *Phyllobius reicheideus*, Desbr., and *P. longipilis*, Boh., which attack the foliage in the adult stage.

SILVESTRI (F.). **A proposito di predatori e di *Prospaltella* nella lotta contro la *Diaspis*.** [Concerning predators and *Prospaltella* in the control of *Aulacaspis*.]—*Bull. Informazioni Seriche*, ii, no. 25, 1915, pp. 654–657.

At least ten years of careful observations will be necessary before an accurate knowledge of the control of *Aulacaspis pentagona* can be acquired. It cannot yet be said that *Prospaltella berlesei* is able, by itself, to check this Coccid effectively. Cases are instanced where the pest has again increased owing to favourable conditions in spite of the

presence of its enemy. It is only in the larval stage that *P. berlesei* attacks the scale, and only one individual is affected. Both the larvae and adults of predatory insects, such as *Chilocorus bipustulatus* and *Rhizobius lophantae*, destroy large numbers of scales, though their work is not so apparent, as the scales are not left attached as in cases of parasitism by *P. berlesei*. These Coccinellids must be considered of prime importance in the control of *A. pentagona* and in no way injurious to *P. berlesei*.

Les traitements à l'eau chaude. [Hot water treatment.]—*Rev. Vitic., Paris*, xliii, no. 1118, 2nd December 1915.

I. SEMICHON (L.). **Traitement des vignes en végétation par l'eau chaude.** [The treatment of vines in active growth with hot water.] pp. 413–414.

Differences in equipment and in the method of operating account for the divergent results obtained by M. Chauvigné [see this *Review*, Ser. A, iii, p. 562] and by the author. The latter used a Vermorel sprayer with a hand pump and a nozzle projecting a coarse spray. The temperature of the liquid at varying distances up to 20 inches is shown by a curve in a diagram illustrating this article. A second curve shows the rapid drop in temperature which occurred when a fine nozzle was used, and a third curve indicates the still greater loss of heat when high pressure was used. In the first case the temperatures were those obtained by the author; in increasing the distance from 4 to 20 inches the temperature was reduced from 158° F. to 139° F. With the fine nozzle, the temperature was reduced from 153° F. to 131° F. With a pressure sprayer, the respective temperatures were 122° F. and 101° F. In all three cases the water in the tank was at 162° F., so that in the last case the drop was very marked immediately the spray left the nozzle—at ⅘ inches the temperature had already fallen to 139° F. and at 2 inches it was only 131° F. The causes are twofold: firstly, the finer particles cool more rapidly and secondly the sudden release from pressure cools the liquid. Spraying with hot solutions must therefore not be done with pressure sprayers or at too great a distance. The wetting power conferred by heat compensates for the loss of wetting power due to the coarse spray.

II. CHAUVIGNÉ (A.). **Théorie de la décroissance du degré de chaleur des pulvérisations chaudes.** [The theory of the decrease in the degree of heat of hot sprays.] pp. 415–417.

The data arrived at are based on (1) a tank temperature of 160° F. at the beginning of operations, (2) the use of a Vermorel sprayer, throwing a fine jet, (3) a surrounding temperature of 65° F., and (4) a distance of 20 inches between the nozzle and the plant. The initial temperature of 160° F. dropped to 151° at 4 inches, to 132° at 8 inches, to 118° at 12 inches, to 110° at 16 inches and 103° at 20 inches. The fall is most marked in the first eight inches. When the contents of the tank were heated to 212° F. a temperature of 117° F. was obtained at the 20 inch limit. As a temperature of 139° F. or 150° F. is required against insect pests of the vine, the hot water treatment is considered useless. The reasons for the loss of heat are discussed.

III. SEMICHON (L.). **Théorie et pratique sur le refroidissement dans les pulvérisations chaudes.** [The theory and practice of cooling in hot sprays.] pp. 417–419.

The reasons advanced by M. Chauvigné are adversely criticised; in any case, theory may be set aside in favour of practical experience, which has proved the real usefulness of hot water—employed according to the author's directions—in controlling insect pests and even certain fungi. It is probable that the equipment at present available is open to improvement, but the method is reliable as it stands at present.

MAISONNEUVE (P.). **Nouveau procédé contre la Cochylis.** [A new method against *Clysia ambiguella.*]—*Rev. Vitic., Paris,* xliii, nos. 1120 and 1121, 16th and 23rd December 1915, pp. 456–459 and 475–480.

After reviewing the various methods of control practised against *Clysia ambiguella* and *Polychrosis botrana,* it is suggested that a more extensive use be made of paper bags for the purpose of protecting the grapes, not only against vine moths, but also against mildew and *Oidium.* It will, of course, be necessary to use sulphur before placing the bags in position, so that any existent mildew or *Oidium* germs may be destroyed. If an acre has 1,600 stocks and each stock averages eight bunches, the total number of bags will be 12,800. A woman can fasten 1,000 bags in a 10-hours day so that just under 13 days' wages or 21 shillings will be needed. The bags will cost about 64 shillings. The total expense per acre will therefore amount to 85 shillings, plus that of removing the bags. Against these costs, may be set the economy in mildew and oidium treatment and the value of those bags which are removed in sufficiently good condition to be used again.

L. D. **Le décorticage contre la Cochylis.** [Scraping the bark as a measure against *Clysia ambiguella.*]—*Progrès Agric. Vitic., Montpellier,* lxiv (32nd year), no. 49, 5th December 1915, pp. 538–540, 10 figs.

This article describes and illustrates the various devices employed in removing the bark from vines as a measure against *Clysia ambiguella.*

RAVAZ (L.) & OBIEDOFF (S.). **Essais de traitement contre Cochylis et Eudémis.** [Experiments in controlling *Clysia ambiguella* and *Polychrosis botrana.*]—*Progrès Agric. Vitic., Montpellier,* lxiv (32nd year), no. 49, 5th December 1915, pp. 540–547, 2 figs.

The conclusions arrived at in these trials are not necessarily of general application, for they depend on the conditions obtaining at the time the work was done, and furthermore the vineyard of the School of Agriculture at Montpellier, where they were carried out, had suffered little from infestation. The first plot was treated with Bordeaux mixture to which $\frac{1}{10}$ per cent. of nicotine had been added; in the second, Bordeaux mixture was used with the addition of $\frac{1}{4}$ per cent. of lead arsenate rendered adhesive with the usual substances; in the third, newly slaked lime was employed; and in the fourth, hot

water—used in accordance with M. Semichon's instructions. A fifth plot was kept as a control. From whatever point of view the results were considered, lead arsenate proved its superiority; the adhesive spray was also superior, for it produced a uniform coat. Nicotine always occupied the second place, while hot water and lime took the last two places, sometimes the one and sometimes the other proving superior. The effect of arsenical treatment, carried out on 10th August against the second generation, on the quality of the wine, is reserved for a future paper.

THOMPSON (W. R.). **Sur les caractères anatomiques et éthologiques des Tachinaires du genre *Plagia*, Meig.** [On the anatomical and ethological characters of the Tachinids of the genus *Plagia*, Meig.] —*C. R. Soc. Biol., Paris,* lxxviii, no. 19, 17th December 1915, pp. 671–674, 1 fig.

The larval stages of *Plagia trepida*, Meig., parasitic on Noctuid larvae, closely resemble those recorded by Pantel, of *Plagia* (*Cyrtophloeba*) *ruricola*, Meig., parasitic on *Spintherops spectrum*. The anatomical characters of all stages of the larva of *P. trepida* are described.

Per distruggere i bruchi dei cavoli. [To destroy cabbage caterpillars.] —*Il Picentino, Salerno,* v, no. 1, January 1916, pp. 31–32.

A 3 per cent. solution of common salt is stated to be a good spray for *Pieris brassicae* on cabbages. The cost may be reduced by employing the chemically treated salt supplied for agricultural purposes.

SCHNEIDER-ORELLI (O.). **Ueber die Selbstherstellung des Raupenleimes.** [The home preparation of banding adhesive.]—*Schweiz. Zeitschr. Obst.- u. Weinbau, Frauenfeld,* xxv, no. 2, 25th January 1916, pp. 19–21.

Two banding adhesives have been recommended in several publications and the formulae for them were recently published in the above journal [see this *Review*, Ser. A, iv, p. 39]. They have since been tested and found to be useless, as they both harden too quickly. It is possible that the difference between European and American resins is the chief reason for this failure.

KEUCHENIUS (P. E.). **Waarnemingen over Ziekten en Plagen bij Tabak. (Tweede Serie). 1. *Opatrum depressum*, F., 2. *Gnorimoschema heliopa*, Low., 3. De Tabaksmot, een nieuwe en ernstige plaag voor gefermenteerde tabak.** [Observations on diseases and pests of Tobacco; (1) *Opatrum depressum*, F., (2) *Phthorimaea heliopa*, Low, (3) the tobacco moth, a new and serious pest of fermented tobacco.]—*Med. Besoekisch Proefstation,* no. 9, 23 pp. (sine loco), 1915.

The life-history of *Opatrum depressum* is described in detail. The eggs hatch in from three to five days and the young larvae were at first fed on tobacco roots, but, the supply failing, potatoes were used

instead and the larvae speedily buried themselves in these. The length of the larval stage was difficult to determine, but probably, on an average, lasts about four months. Pupation takes place about 4 inches below the surface; the pupal stage is very short, being barely a week. During the West Monsoon, the beetles are very sluggish but they are active in August and December and fly in swarms to lamp light. Microscopical observations of the ovaries from January to May showed that the eggs are not ripe until May and it would thus appear that the beetles are not sexually mature till six or seven months after emergence, viz., in the months of June, July and August, and thus the whole life-cycle of the insect embraces nearly a year. Both adult and larva damage tobacco, the former gnawing the root-collar and the latter the tap-root. The damage done by *O. depressum* in some places is very marked, and frequently the whole of a plot of planted out tobacco is destroyed by the beetles or the larvae. This occurs chiefly with autumn tobacco; spring tobacco, which is generally planted out in February and March, is but little attacked because at this season no larvae are present and the beetles are not feeding freely. The destruction of spring tobacco is generally due to Melolonthid larvae and very often to the operations of large earthworms. *O. depressum* frequently does much damage also in coffee plantations. The attacks of this pest are often very local, and in an experimental field planted with spring tobacco, which had carried various kinds of leguminous plants in the previous year, only those sections of the field were attacked by the beetles which had been previously planted with *Phaseolus lunatus.* Though the beetles come in swarms to light, poor results were obtained in trials of this method of capture. Flooding the soil or setting traps of banana leaves, on the upper side of which the larvae collect, is more effective, and spraying with a solution of soap and tobacco extract is also suggested. Earth containing 5 per cent. of naphthaline placed at intervals between the rows of plants, as advised by the Deli station, did not prove successful, as the naphthaline soon evaporated. Spraying the soil with a 1 per cent. solution of potassium sulphocarbonate is suggested as probably effective and experiments with this are in progress at Deli.

The identity of the moth, known in Deli as "toa-toh" and by other names in other parts of Java, is discussed at some length. It has been generally known as *Lita solanella*, Boisd, which is a synonym of *Phthorimaea operculella*, Zell., the world-wide potato pest. Although attacking the potato tuber, the latter moth is as a matter of fact more especially a miner of the upper surface of the leaves and stems of the potato, tomato, aubergine and other Solanaceous plants, and also of tobacco. *P. operculella* is thus in no sense a definite stem-borer, as is the moth under consideration, and the author is convinced that the East Indian toa-toh is *Phthorimaea* (*Gnorimoschema*) *heliopa*, Low., recorded by Lefroy as the "tobacco stem-borer" and known as such only in British India, Ceylon, Sumatra, Java and Australia.* The eggs are generally laid on the leaves and the egg-stage lasts about five days, the newly-hatched larvae being so small as to be almost invisible to the naked eye. The larvae bore into a vein of the leaf and quickly reach the midrib; occasionally they bore into the leaf-tissue and make

*[This moth is well known as a tobacco pest also in East and South Africa.—Ed.]

holes in it, but in these cases, the larva generally quits the leaf-tissue and begins a fresh burrow in a vein. From the midrib, after boring out the pith, the larva reaches the main stem through the petiole and makes its way to the growing point. If the egg has been laid on an old, fully developed leaf, the larva rarely reaches the main stem, but completes the stage in the petiole. The larval stage lasts from 21 to 24 days, and as soon as the time for pupation arrives, the larva bores an outlet to the exterior, leaving the epidermis over the hole, the transparent spots thus produced being readily visible on attacked plants. The larva then retreats somewhat and spins a small but very thick cocoon. The pupal stage lasts 6–8 days and the whole life-cycle 34–37 days.

With regard to the question as to what becomes of this insect during the time that there is no tobacco on the fields, the author's experiments showed that both sexes only live a couple of weeks after pairing. Observations are in progress on a large number of autumn tobacco plants with the object of determining whether the pest survives as a dormant larva, a pupa or as an imago, and also whether there is some other food-plant which enables the insect to tide over the intervals between the tobacco crops. De Bussy has sought for such an alternative food-plant near Deli for seven years without avail, and the author has examined all possible plants wild and cultivated also without result. As *P. heliopa* is indigenous to Java and has spread from the East Indian archipelago to Australia on tobacco, while tobacco is not indigenous, it follows that there must be an alternative food-plant, though wild tobacco to a large extent serves this purpose at present. The author has not been able to discover in Besoeki the parasite found by de Bussy in Deli, and up to the present no insecticides have given a useful result. As the infestation was thought to take place on the very young plants in the nurseries, covering with mosquito-netting as soon as night fell was tried, but this method is considered useless because the real infestation takes place after planting out, while, in the nurseries, the fact that the plants are close together prevents oviposition and only those on the borders of the beds are attacked. On the other hand, freshly planted tobacco is attacked before the young plants have had time to recover from the effect of removal and therefore resist so badly that large numbers of them die. As the larvae can apparently feed on and develop in withered plants, all these should be burned and all seedlings in the nurseries, not planted out, should be similarly destroyed.

The third article of this series deals with a new and serious pest of fermented tobacco. The head of a large tobacco factory at Besoeki complained that the fermented and baled leaves were seriously attacked by an insect which was apparently not the well known pest, *Lasioderma serricorne*, F. This proved to be a Tineid moth, the stages of which are described and figured. The egg-stage lasts seven or eight days; attempts to determine the length of the larval stage failed. The larvae make galleries between the bundles in the bale which are lined with excrement and loose web; they move rapidly when disturbed and are very sensitive to light; the cocoons are enveloped in excrement. The pupal stage lasts 15 days. On opening a bale, quantities of the larvae are to be found and the upper layers of leaf bundles are seen to be eaten and bored to a depth of about 2 inches so that all bales

in the factories infested had to be opened and disinfected. Evidence was obtained that the pest had been known in one factory for several years, but it is apparently not as yet very widely spread, as it was quite unknown to many planters. According to Peter and Schwarz, *Tinea pellionella*, L., infests prepared tobacco, and as the author succeeded in feeding the larvae on woollen material, he thinks it probable that the pest in question is also a clothes moth which has acquired new habits. Larvae, pupae and adults were killed in five hours by a temperature of 105°-108° F.; the attack must therefore occur after fermentation is complete, and it is clear that the damage may progress in a ship's hold on the voyage to Europe and that one infested bale may cause the ruin of a whole consignment, though from trials made with bales in the factory, a certain amount of moisture seems to be required to allow of infestation. Fumigation with carbon bisulphide for 24 hours, as against *Lasioderma serricorne*, will kill this pest, and as preventive measures, extreme cleanliness and the destruction of moths in the packing sheds and materials, are very necessary. Quantities of larvae were found in the cracks between the floor-boards of the drying shed, and attention to these and similar defects would do much to diminish this pest.

LEEFMANS (S.). **De Cassave-Oerets.** [The Cassava Grubs.]—*Dept. Nijverheid, Landbouw en Handel.—Med. van het Laboratorium voor Plantenziekten, no. 13, Buitenzorg*, 1915, 118 pp., 7 pls., 4 tables of curves. [Received 16th December 1915.]

For the past eight years the cultivation of cassava has been carried on on a large scale in Java. Two years after the cultivation was established, various grubs began to do serious damage to the crops and for six years the planters did what they could to keep down the pests, but with little success, and the matter was put into the hands of an entomologist to devise a remedy. The conditions of cassava culture are such that the plant is always in the ground providing food for the grubs and there is no rotation of crops. The two beetles especially destructive to cassava, are *Leucopholis rorida*, F., and *Lepidiota stigma*, F., of which the former does the most damage. This species, in which the sexes are much alike, is described, two other species being known in Java, viz., *L. emarginata*, Burm., and *L. molitor*, Burm. The adults of *L. rorida* are chiefly on the wing during the west monsoon, the numbers decreasing from October to December. The chief damage is done between March and May. A list of 19 food-plants is given, and there are probably many others, so that there is no hope of catching the beetles in any quantity by the use of trap crops. The natives utilise the marked preference of these beetles for *Capsicum annuum*, L., by rubbing the red pods on stones, fencing, etc., in the evenings, thus attracting large numbers. As, however, the males only are attracted by this method, it is not considered of much value. Experiments to ascertain the numbers of females captured by different methods showed that digging up the beetles first before they emerged produced 42 per cent., catching them in the ground at dusk 23 per cent., by the capsicum bait method 3 per cent., and by torchlight, by which a large number were taken in copula, 60 per cent. Various practical

difficulties stand in the way of complete success in controlling the numbers, but by employing 25 men on 78 acres to go over the ground once at dusk, 20,617 males and 1,547 females were caught, while search from dusk till one hour after nightfall yielded 3,452 males and 3,029 females, and on a limited area the results of this method were distinctly good, the damage being reduced to about one-third. It was observed as far back as 1912 that numbers of the beetles passed the day in trees, but these consisted largely of females which have already completed their oviposition. The fact that these beetles, especially the females, live in the ground during their most dangerous stages makes any really useful control measure exceedingly difficult, and the author is of opinion that there is no method by which they can be caught in quantity, though efforts should be directed towards destroying them as soon as they emerge. Investigations into the depth at which the eggs are laid in the soil, gave results varying from 8 inches to three or four times that depth, though 75 per cent. of the observations gave a depth of over 12 inches; the majority of the larvae were found at 20 inches below the surface. They are markedly cannibalistic in their habits. No very serious damage is done between October and January, but the plants then begin to droop owing to damage to the roots. In the earlier stages of attack the injection of carbon bisulphide into the soil between the plants should give good results. When the plants are very young, the grubs eat the stems and the young roots, causing death. Many thousands of grubs of this and other species are to be found in the vegetable rubbish which should be cleared off the ground between the plants. The larvae of *Leucopholis* also attack maize, ground-nuts, arrowroot and sweet potato. The life-cycle is as follows:—The beetles emerge from the soil about the middle of October, the egg-stage lasting 19 to 23 days in October and November and the larval stage about nine months, from December to August. The resting stage of the larva previous to pupation lasts 8 to 32 days, the pupal stage four to five weeks and the emergence of the beetles, with about seven weeks of inactivity, occupies the time between August and October; one generation thus lasts about a year.

Lepidiota stigma, F., is not so common in cassava fields as *Leucopholis rorida*, F., and is somewhat local. Care is required to distinguish the sexes. Capsicum does not attract the beetles, but they come to light and are occasionally found above ground, though more strictly a night feeder than *L. rorida*. This beetle feeds on many plants, including tamarinds, *Arachis* spp., kapok, *Citrus* spp., avocado, etc., tamarind being the favourite food. Laboratory observations on the larvae were almost impossible owing to their cannibalistic habits. The life-cycle is as follows: Egg-stage, 15 days in November; larval stage, about 9 months, December to August; resting stage of larvae, 12 days in September; pupal stage, one month in October; the imago occurs from October to December, the cycle thus covering a year. The larvae of this species are reported to have destroyed nearly 30 acres of sugar-cane in one locality. The larvae of *Xylotrupes gideon*, L., which do great damage to sugar-cane, are also serious pests of cassava.

The following list of minor pests of cassava is given, the bionomics of each species being discussed:—*Euchlora subcoerulea*, Hope (*nigra*, F.); *Anomala obsoleta*, Blanch.; *A. anchoralis*, Lansb.;

A. antiqua, Gyl. (*aerea*, Perty); *Brahmina pumila*, Sharp; *Lepadoretus compressus*, Web.; *Adoretus sciuinus*, Burm.; *Holotrichia leucopthalma*, Wied.; *H. helleri*, Brsk.; *Popillia biguttata*, Wied.; and several undetermined species of *Serica*.

The underground habits of the larvae protect them very considerably from the attack of insect parasites. The adults are destroyed by owls and bats, as well as by crows and starlings, which follow the plough and pick up the grubs. The following Scoliid wasps are known to parasitise the larvae: *Dielis annulata*, F.; *D. luctuosa*, Smith; *D. tristis*, Sauss.; *D. javana*, Lap.; *D. thoracica*, F.; *D. formosa*, Guér., *Triscolia rubiginosa*, F., as well as two undescribed species of *Dielis* and an undetermined species of *Tiphia*. The bionomics of these insects is given at length, and it is stated that about 26 per cent. of the beetle larvae are parasitised by *D. thoracica*. A species of *Sarcophaga* and a Tachinid parasitise *Leucopholis* and *Euchlora*, but there is no evidence of effective control. Attempts have been made to obtain beneficial parasites from the United States and from Porto Rico, but these have been unsuccessful, as have trials of various fungi. Observations are in progress on parasites of the useful Scoliids with a view to their destruction; large numbers of *Dielis thoracica* have been found dead and an undetermined Conopid fly is suspected of being the cause. Apparently the only practicable method of getting at the larvae is by ploughing and cross ploughing the land, collecting all the larvae possible by hand and allowing crows and other birds to assist in their destruction; this method is, however, costly both in time and money, amounting to more than £2 10*s.* per acre. The results are given of experiments with a number of chemical poisons, but the author comes to the conclusion that none of them were of any use against grubs attacking the roots of the living plants, though carbon bisulphide proved the best. As the grubs of *Leucopholis* absolutely refuse to eat *Agave* it is suggested that this plant should be used in rotation and that, in this way, a given area of ground might be cleared of the pests by a process of starvation.

Hall (C. J. J. van), Rutgers (A. A. L.) & Dammermann (K. W.). **Bestrijdingsmiddelen tegen Plantenziekten en schadelijke Dieren.** [Methods of combating plant diseases and injurious animals.]—*Dep. Landbouw, Nijverheid en Handel.—Med. van het Lab. v. Plantenziekten, Buitenzorg*, 1915, 42 pp., 13 figs. [Received 16th December 1915.]

This is a general review of the methods now employed for the control of insects and fungi attacking cultivated plants. These are classified under the following heads: Indirect methods include the cultivation of crops so as to secure a maximum of power of resistance; the results of the use of stable manure for *Coffea robusta* is cited as an example, and the fact that feeble plants are specially attacked by scale-insects and Aphids. The choice of disease-resisting varieties is exemplified in the good results obtained in Java coffee cultivation, which formerly suffered very seriously from leaf disease; sugar cultivation in the Antilles has been similarly helped by replacing the highly susceptible Bourbon variety of cane by other sorts, and in Java

by a similar replacement of the Cheribon variety. In Surinam the banana known as Gros Michel, which was very liable to the so-called Panama disease, has been replaced by the Congo variety which is not susceptible, while the substitution of American vine-stocks for European ones as a means of avoiding attack by *Phylloxera*, is perhaps the best example of this method. Rotation of crops is one of the best means of combating individual pests or groups of pests, and this has been well exemplified in the cultivation of cotton in the United States, and has proved of the greatest value in sugar and cassava plantations. The removal of all local conditions likely to favour the growth and development of fungi and injurious insects, the removal of old stumps and roots on newly broken ground, the free admission of light and air, and the avoidance of overcrowding have proved of the greatest benefit in *Hevea* and cacao cultivation; to these may be added the capture of harmful insects whenever possible by hand, traps, lights or trap crops. In recent years the biological methods of control by the propagation and distribution of parasites and other enemies of insect pests have assumed great importance.

Among direct methods the most important are:—The disinfection of seed and plants, the treatment of the plants themselves with fungicides or insecticides and the disinfection of the soil. The methods and materials employed in these measures are discussed and the various forms of spray apparatus in use are described and figured. The use of ammonia gas, potassium bicarbonate, carbon bisulphide, carbolineum, chloride of lime, quick lime and formalin as soil disinfectants is summarised, and some idea of the average cost of material and appliances is given.

DAMMERMANN (K. W.). **De Rijstboorderplaag op Java.** [The rice-borer pest in Java.]—*Dept. Landbouw, Nijverheid en Handel.—Med. Lab. voor Plantenziekten, Soerabaia,* 1915, 70 pp., 7 plates. [Received 16th December 1915.]

The following summary of this paper is given by the author.

At present, five species of rice-borers are known in Java, viz:—*Schoenobius bipunctifer*, Wlk., *Scirpophaga sericea*, Snell., two species of *Chilo* and *Sesamia inferens*, Wlk. The most serious pests of rice are the two first named; *S. bipunctifer* occurs throughout Java, while *S. sericea* is principally found along the north coast and is more common there than *Schoenobius*. *Sesamia inferens* generally prefers maize to rice and is only abundant on upland rice. The rice-borers have several parasites, one of which, *Trichogrammatoidea nana*, Zehnt., may destroy up to 60 per cent. of the eggs. The loss of crop caused by stem-borers may amount to 10 per cent. and in some years reaches 50 per cent. After the harvest, many borers remain in the dry stems. When the rice is harvested at the close of the rainy season (April-May), as is generally the case, and the fields lie fallow during the dry season, the borers hide in the stumps, where they remain from May to October. At the beginning of the next rainy season, the caterpillars pupate and the moths emerge and lay their eggs on the seedbeds of the next crop. The regions, which suffer most from borers are those where many fields remain unprepared and unplanted during the dry season,

because water for irrigation is not available. When two crops of rice are grown in succession, the second crop may be infested by the offspring of the borers of the preceding one, but if the fields are carefully cultivated and harvested regularly, the damage is less serious. The pest is most efficiently checked by crop rotation, using a crop on which borers cannot feed. The insects are most abundant after very dry seasons followed by late rainy ones. All varieties of rice are liable to the attacks of borers, nor do varieties appear to exist which are obviously preferred by borers. In some districts, however, the bearded varieties are more seriously infested than the non-bearded types. Weak varieties which stool badly, are more damaged by these insects than others The most effective method of control of this pest is to destroy the borers, which remain in the stubbles after the harvest. Deep ploughing immediately after the crop is reaped, is the best remedy; if this is impracticable, as in many non-irrigated districts, burning the stubbles is advised and good results were obtained by this method. It is not advisable to grow two or more crops of rice in succession, unless large areas can be prepared and reaped at the same time. Another important measure is to kill the first brood of the borers; the egg-clusters on the seed-beds should be collected by children and the seed-beds should therefore be arranged in rows 40 inches wide. Collection of the egg-clusters should begin when the plants are one week old and should be repeated every five days. Infested seedlings should not be transplanted, but should be removed and burnt or buried the same day. Light traps may be put near the seed-beds to capture the moths. Ordinary kerosene lamps placed in the centre of a tray containing water with a film of kerosene or other oil are most useful; they should be sheltered against rain. The best results were obtained with an apparatus consisting of a wooden framework, the sides of which are covered with cheesecloth, leaving free only narrow slits, above which are fastened strips of wire gauze, which slant downwards. The bottom of the case contains the tray with water and oil, the lamp being placed inside. By this method more moths are attracted, and of these only a few escape. By distributing large coloured engravings and pamphlets in Dutch and Malay, the natives and others are being made acquainted with the life-history of these borers and the methods of controlling them.

Ishida (M.). **Onderzoekingen over boorders en boorderparasieten in het suikerriet van de Cultuurafdeeling van het Proefstation te Pasoeroean.** [Investigations on borers and borer-parasites in the sugar-cane of the Experiment Station in Pasoeroean.]—*Med. Proefstation Java-Suikerindustrie, Soerabaia*, pt. v, no. 12, 1915, 17 pp. [Received 16th December 1915.]

The materials for these investigations on sugar-cane borers and their parasites included eggs of *Diatraea striatalis* collected under natural conditions, and of 5,068 egg-masses examined from 30th January to 5th March, 37·6 per cent. were found to be free. This percentage was

arrived at by adding to the number of entirely healthy egg-masses half of those partially infested. Investigation of the proportion of the sexes of *Prophanurus* (*Phanurus*) *beneficiens* showed that about 4 per cent. of males occurred. The great predominance of females may account for this species being such a very effective parasite in Java.

ROEPKE (W.). **Verslag over het jaar 1914-1915 en Werkprogramma voor het jaar 1915-1916.** [Report for the year 1914–15 and programme for the year 1915–16.]—*Med. Proefstation Midden Java, Batavia*, no. 20, 1915, 30 pp.

Some estates suffered seriously from locusts, which appeared to come from the teak areas and to be the same species as had previously done great damage in dry years in Java, viz., *Cyrtacanthacris nigricornis*, Burm. (*Acridium melanocorne*, Serv.). There was one large primary and several smaller secondary centres, the former coinciding with the teak forest belt of Central Java. No reasonable method of control in the forest was possible, as the locusts kept to the tops of the highest trees. In the secondary areas, molasses and arsenic was tried as a bait with some success; buffalo dung poisoned with Paris green was found very useful, as the dung appears, to have a special attraction for the locusts. The chief damage was done to plantations near to the teak forest. Natural enemies greatly helped the destruction of the pest; the fungus, *Metarrhizium anisopliae*, attacked them in all stages; the Cantharid beetle, *Mylabris pustulata*, destroyed large numbers and the eggs were heavily parasitised by the Chalcid, *Scelio javanica*. Attempts are being made to maintain a supply of the fungus during the intervals between the locust invasions for subsequent use, and locusts infected with it were sent to Kuala Lumpur and to Pusa for experiments in cultivating it.

An unknown beetle greatly resembling the Mango weevil, *Cryptorrhynchus mangiferae*, did great damage to pepper-corns; hand collection and shaking from the trees are probably the best methods of control; nothing is as yet known of the life-history. In July and August and again in November and December there was a great outbreak of bag-worms, chiefly *Eumeta layardii*; shade trees were badly attacked and also kapok, cacao, coffee, pepper and nutmeg. An epidemic of LIMACODIDAE occurred and it was observed that, whereas in previous years *Orthocraspeda trima* was the species most feared by the cacao planters, this species was entirely absent and its place taken by *Altha castaneipars*, which the author thinks has been often wrongly recorded in Java as *Belippa laleana* or *Belippa* sp.; another undescribed Limacodid also did much damage; *Scopelodes unicolor*, the largest Limacodid in Java, as well as *Setora nitens* and *Miresa albipuncta* were present in small numbers. The kapok pod-borer, which in former years has damaged a great percentage of the pods of kapok, has been bred out and appears to be a new species closely

related to the Noctuid, *Mudaria cornifrons* of India, which bores in the wild kapok, *Bombax malabaricum*; this insect will shortly be described in the "Tijdschrift voor Entomologie" as *Mudaria variabilis*, sp. n. *Xyleborus robustae* has been found on *Tephrosia vogeli*. The *Helopeltis* problem requires much further study; the insect has now been found to live on *Eryngium foetidum* and on *Inocarpus edulis* [Fiji chestnut]. A new species of *Acrocercops* was found on *Zaraca declinata*, and attention has been directed to another insect closely related to the cacao moth which has been found on *Bauhinia variegata*; the caterpillar lives in the flowers and pupates on the leaves; the cocoons are much smaller than those of *Acrocercops cramerella* and are parasitised by the Ichneumonid, *Photoptera erythronota*, which also attacks the cacao moth [see this *Review*, Series A, i, p. 56]. The plant is possibly useful as a means of propagating the parasite.

Further research has shown that where the Gramang ant, *Plagiolepis longipes*, is present the development of *Coccus* (*Lecanium*) *viridis* is clearly favoured. In cacao plantations, the Gramang ant does harm by driving away the black cacao ant, *Dolichoderus bituberculatus*, which exposes the cacao to more serious attack by *Helopeltis*. Various methods of destroying *P. longipes* have been tried, but the only one which gave practical results was the placing of fallen leaves in holes in which the ants collected in numbers, covering them with earth and treating with carbon bisulphide. *D. bituberculatus* is not regarded as assisting the development of *C. viridis* to the same extent as *P. longipes*. Altogether, 15 species of parasitic Hymenoptera have been bred from *C. viridis*, some of which appear to be hyperparasites, the most common being the Chalcid, *Encyrtus bogoriensis*, Koningsb. The Coccinellids, *Chilocorus melanophthalmus* and *Orcus janthinus*, do not appear to be capable of keeping down the scale within really useful limits, and a study of the habits of these and other Coccinellids has shown that their food is very restricted. *Chilomenes sexmaculata* does not eat scale-insects, and *Chilocorus* and *Orcus*, while feeding greedily on *C. viridis*, will not eat the white cacao scale, *Pseudococcus crotonis*, or the lamtoro scale, *P. virgatus*. The pods of *Tephrosia candida* and *Crotalaria striata* are attacked by the coffee weevil, *Araecerus fasciculatus*, which, in captivity, will also feed on the pods of lamtoro (*Leucaena glauca*) and on *Tephrosia vogeli*, but not in the open. From a few pods, a considerable number of parasitic Hymenoptera were bred, including two Braconids and three Proctotrupids. A number of small Tineid larvae were obtained from the pods among those of *Araecerus*, and they may also be enemies, though further investigation is required. A very large Monophlebid scale-insect has been found on the shade trees, *Deguelia microphylla*, as well as on *Albizzia moluccana*, *A. stipulata* and *T. vogeli*. Should this scale attack coffee and cacao, the consequences would be serious, as the quantity of honey-dew produced is very great; this scale is parasitised by an Agromyzid, *Cryptochaetum chalybeum*, Meij., which unfortunately has a large number of hyperparasites.

GOOT (O. van der). **Over eenige engerlingensoorten, die in riettuinen voorkomen.** [On certain beetle larvae, found in sugar plantations.]—*Med. Proefstation voor de Java Suikerindustrie*, pt. 5, no. 10. (Reprint from Archief voor de Suikerindustrie in Med.-Indie, pp. 275–316), *Soerabaia*, 1915, 60 pp., 13 figs.

In February and May of 1914, when Muir from Hawaii was in Java searching for parasites of *Adoretus compressus*, instructions were given to the plantation coolies to collect all the grubs they could find in order to assist him. The material so collected is dealt with in this paper, which contains descriptions of 16 species with the localities in which they are found and notes on their bionomics and parasites. *Adoretus compressus*, Web., is attacked both in the larval and adult stages, by *Metarrhizium anisopliae* and by *Bacillus gigas*, sp. n., which destroyed numbers of the larvae in the insectary. A Tachinid parasite, *Prosena siberita*, which is common in Java, also attacks the larvae; the fly is thought to lay its eggs on the ground and the larvae on hatching seek their host in the soil; this parasite is thought to have some importance. Other minor enemies are two Asilids, *Emphysomera conopsoides*, Wied., and *Philodicus javanus*, Wied. A species of *Tiphia* and the Ortalid fly, *Campylocera robusta*, van der Wulp, have been found to be parasitic on the beetles, but the proportion attacked by the latter insect is very variable, though sometimes amounting to 50 per cent. The damage done varies and the numbers of the beetles seem to have some relation to the use of animal manure. *Anomala antiqua*, Gyll., lives in vegetable rubbish and is only occasionally harmful. *A. obsoleta*, Bl., also lives in vegetable rubbish and is of little importance as a pest of sugar-cane. *A. pallida*, F., was found only in very small numbers. The larvae of *Aphodius marginellus*, F., are only found in manure and vegetable rubbish and do not attack living plants. *Holotrichia constrictor*, Burm., is not common and probably of no consequence as a pest of sugar-cane. *H. helleri*, Brsk., was the commonest larva found in the sugar plantations in 1914; the larvae have probably been confused previously with those of *Apogonia destructor*. Much harm was done by it to the roots of various cultivated grasses. *H. leucophthalma*, Wied., is probably of small account as a sugar-cane pest. The bionomics of *Lepidiota stigma*, F., and *Leucopholis rorida*, F., are also dealt with [see this *Review*, Ser. A, iv, p. 82]. *Oryctes rhinoceros*, L., in cane plantations is always found among rotting leaves, etc., and apparently lives its whole life on decaying vegetable matter being therefore harmless to sugar-cane. *Protaetia fusca*, Herbst, also lives on vegetable refuse, and so far as is known, living plants are not attacked, nor can *Xylotrupes gideon*, L., be regarded as a pest of sugar-cane. A table is given at the end of the paper showing the characters of the larvae of each of the 16 species.

POETEREN (N. van). **De "Roode Worm" der Frambozen, *Lampronia rubiella*, Bjerk.** [The Red Raspberry Worm, *Lampronia rubiella*, Bjerk.]—*Tijdschr. Plantenziekten, Wageningen*, xxi, pts. 5–6, 1915, pp. 131–152, 2 plates. [Received 21st December 1915.]

This paper describes the life-history of, and the nature of the damage done by, *Incurvaria* (*Lampronia*) *rubiella*, Bjerk., in Holland,

the outbreak of which has already been described [see this *Review*, Ser. A, iii, p. 741]. This pest has hitherto been regarded as only of sporadic occurrence in Holland, but inquiry shows that it is far more common than was supposed and that the damage done is very serious. The cocoons of *Incurvaria rubiella* are stouter than those of *I. capitella* and the caterpillars leave their winter quarters much later. In 1915 they were found in large numbers in the first week of April. The tops of the canes are chiefly attacked. In 1911, at Zundert, the crop was reduced to one-third, and in other years the loss has been still greater. The pest first makes its appearance in plantations not less than three years old and never in those only two years old, even when they adjoin older plantations. This is probably due to the fact that the young canes are cut down to within about 12 inches of the ground, and these bear few if any flowers for the moths to oviposit in until the second year, when the real attack takes place, the effect of which begins to be manifest in the third year. A very prickly variety of raspberry called the "vroege bruine" (early brown) was much less attacked than the other sorts, but no such immunity was observed in the ordinary cultivated varieties.

Various methods of control are discussed, none of which was completely satisfactory. A thorough spraying with 8 per cent. carbolineum, so that much of the liquid ran down the canes into the soil, and lightly spraying the soil between the plants with the same solution, were the most effective; no harm resulted to the plants from this heavy dressing. A table is given showing the results of various methods of control and the weight of fruit obtained from four lots of cane, 210 in each. The canes treated with carbolineum only gave the greatest weight, 613 lb., the untreated series yielding only 532 lb., which, considering the difficulty of controlling this pest, is regarded by the author as a fairly satisfactory result.

POETEREN (N. van). **De Verordeningen Nopens de Bestrijding van den Knopworm en de Bessenspanrups in de Gemeenten Zwaag en Blokker.** [The regulations compelling the control of *Incurvaria capitella* and *Abraxas grossulariata* in the communes of Zwaag and Blokker.]—*Tijdschr. Plantenziekten, Wageningen,* xxi, 1915, pp. 160–168. [Received 21st December 1915.]

The carbolineum spray recommended against *Incurvaria capitella* [see this *Review*, Ser. A, iii, p. 643] has proved very satisfactory and the yield has greatly increased on the sprayed bushes.

As the fruit gardens in the Bangert district are practically continuous, combined action against insect pests is very important, and the communal Council has issued an order of which the following are the principal provisions: Every occupier of land on which red, white or black currants or gooseberries are cultivated is required to notify the burgomaster of the area under such cultivation before 1st November in each year; the carriage of any plants or parts of plants of the above into or out of the district after 1st February, without permission of the burgomaster, is forbidden; any attempt to evade this regulation to be punished by confiscation and destruction of the plants; the authorities and the staff of the phytopathological service to have free access to land under such cultivation at all times between sunrise and

sunset; all cultivators of such crops must carry out the instructions issued for the control of *I. capitella* and *Abraxas grossulariata*, which will be published on 1st December in each year; if the orders are not obeyed, the work may be done by the authorities and charged to the owner; refusal may be punished by fine or imprisonment; the details of the methods to be used will be published at least a month before they are required to be carried out.

JEPSON (F. P.). **Report of the Entomologist.**—*Dept. Agric., Fiji, Ann. Rept. for the year 1914, Suva*, 6th May 1915, pp. 17–27. [Received 7th January 1916.]

Bananas in Fiji are attacked by the Coccids, *Aspidiotus destructor*, *A. aurantii*, *A. dictyospermi*, *A. cyanophylli*, *A. excisus*, *A. transparens*, *A. lataniae*, *A. palmae*, *Hemichionaspis aspidistrae*, and *H. minor*. The scales appear to be less abundant during the summer than at other times, isolated females only being present. Thorough spraying at this time should prevent these from giving rise to new colonies. Bananas from scale-infested districts were fumigated for three hours with hydrocyanic acid gas before shipment to Australia. The scalecides in common use in Fiji are kerosene emulsion and lime-sulphur wash. *Cosmopolites sordidus* (banana borer) was less abundant than in previous years, especially in districts in which predaceous Histerid beetles from Java (*Plaesius javanus*) had been established.

Coconuts on Vitilevu were attacked by *Levuana iridescens* (coconut leaf-moth). Preliminary experiments in the control of this insect on mature trees showed that it was impossible to reach the top of the trees with ordinary spraying apparatus. Young trees sprayed with lead arsenate were freed from the larvae. The application was repeated five weeks later, allowing 30 oz. lead arsenate to 25 gals. water; each tree required about 4 gals. of the solution. Attempts to control the larvae by smoking them with long torches, a method adopted in Malaya, were unsuccessful. A fungus, *Botrytis necans*, which destroys the larvae of *Brachartona catoxantha* on coconuts in the Straits Settlements, was imported from Singapore with the object of testing its effect on *L. iridescens*. *Trachycentra* sp. (a boring moth) was associated with a certain amount of damage to coconuts, young trees being especially subject to attack. Larvae were found in the heart leaves and in the bases of the leaf-stalks of a three-year-old specimen. It is believed that the death of many trees is due to "bud-rot," bacterial or fungoid, and that the decomposed heart induces oviposition by flies and moths, including *Trachycentra* sp. *Rhabdocnemis* (*Sphenophorus*) *obscurus* (sugar-cane borer) caused slight damage to young trees by boring into the woody base of the leaf-stalk. This beetle probably never attacks healthy trees and some other cause of injury must be sought for. If affected trees show no hope of recovery, the best plan is to burn them. This beetle is primarily a sugar-cane pest and will not attack coconut if sugar-cane is available. *Pseudococcus pandani* was observed on a young tree. The heart leaves were heavily infested and gummed together by excreta and honey-dew. The insects may be destroyed by placing a handful of salt in the crown of infested trees, or by pouring in salt solution or sea-water.

Rubber was attacked on one estate by *Aspidiotus cyanophylli*, a scale which also injures bananas, guavas and palms. This insect should be sprayed, as soon as observed, with lime-sulphur, kerosene emulsion or red oil. The bark of young trees was occasionally damaged by crickets. These can be destroyed by poisoned baits prepared according to the following formulae :—(1) 25 to 40 lb. bran or pollard, 1 lb. Paris green, molasses and water to form a thick mash ; (2) finely chopped grass, 1 lb. sodium arsenite, 7 lb. molasses, 12 gals. water.

Pineapples were injured by a small species of rhinoceros beetle and by an unidentified mealy-bug. The latter was destroyed by fumigation before export. Crickets were reported on *Agave rigida* var. *sisalana* (sisal) in a newly-planted area, where shelter was afforded by a dense crop of weeds. Among ornamental plants, an *Oreodoxa regalis* (royal palm), which had died of " bud-rot," was found to harbour Dipterous larvae and earwigs. In addition to the Coccids found on bananas, *Aspidiotus hartii* on yams and *Chionaspis citri* on oranges are recorded.

The importation of vegetable matter from certain prescribed countries is forbidden by Proclamation no. 24 of 1913, to prevent the introduction of *Oryctes rhinoceros* (rhinoceros beetle), except in certain instances where special permission has been obtained and the stock inspected and fumigated.

FREEMAN (W. G.). **Report on Locusts in Venezuela.**—*Bull. Dept. Agric., Trinidad and Tobago, Port of Spain*, xiv, no. 6, 1915, pp. 191–194, 5 plates.

The locust found in Venezuela at the end of May 1915 was *Schistocerca paranensis*, and was identical with that occurring in Ciudad Bolivar in January 1915. *Cassia occidentalis* (negro coffee) was apparently a favourite food-plant. A plot of bananas and scattered *Erythrina umbrosa* (immortel trees) were completely defoliated ; a coconut plantation was also badly attacked, while in an adjoining garden young beans were destroyed, though tomatoes were almost untouched. Cacao was injured to a very slight degree. *Acrocomia sclerocarpa* (gru-gru palm) and *Oreodoxa oleracea* (cabbage palm) were slightly attacked. The locusts were most active in the afternoon and their general direction was easterly or north-easterly towards Trinidad. The sea and contrary winds, however, have up to the present proved effective obstacles against an invasion of Trinidad. Nevertheless, should the present swarm be succeeded by a larger generation, the likelihood of an invasion of Trinidad will be greatly increased.

URICH (F. W.). **Notes on the South American migratory Locust** (*Schistocerca paranensis*, **Burm.**), *Bull. Dept. Agric., Trinidad and Tobago, Port of Spain*, xiv, no. 6, 1915, pp. 194–197.

The habits of *Schistocerca paranensis*, Burm., were studied at Guiria, Venezuela, during August 1915. The swarms were small and isolated, consisting of hoppers in the last instar, and it was estimated that adults would appear during the first half of September. The hoppers were very active in the sunshine, and at night congregated on the tops of low-growing shrubs and trees. The rate of advance in search of

food-plants varied. In cacao a swarm advanced 100 yards in half an hour; other swarms under observation advanced three-quarters of a mile in a day. In the Guarama district the swarms seemed to be travelling in a westerly direction. Coffee leaves were not touched and guinea grass was only injured to a slight extent. After maize, bananas were the favourite food-plant. Other plants attacked included cacao, *Heliconia* sp., carat palm, gru-gru palm, castor oil plant, nettle, cassava, etc. The dense tropical growth of the country, with the exception of a few small open savannahs covered with grass, appeared to restrict oviposition. Suitable breeding grounds were small and scattered, resulting in the small isolated swarms found all over the country. No natural enemies of any consequence were observed. The following is a summary of the developmental stages:—Adults ovipositing, 1st June; first appearance of hoppers, 25th June; first appearance of next generation of adults, 29th August. So far as could be ascertained, a great part of the peninsula forming the north-westerly border of the Gulf of Paria was infested by isolated swarms of hoppers.

RORER (J. B.). **Report on the Inoculation of Locusts with** *Coccobacillus acridiorum*.—*Bull. Dept. Agric., Trinidad and Tobago, Port of Spain*, xiv, no. 6, 1915, pp. 197–198.

Inoculation experiments with *Coccobacillus acridiorum* against *Schistocerca paranensis* (Venezuelan locust) and *Tropidacris dux* (giant locust) showed that this organism is virulent for both these insects, and that the virulence could be increased by passage through a series of them. Pure cultures were made of the organism for use, should occasion arise.

COLLENS (A. E.). **The Manurial Value of Locusts.**—*Bull. Dept. Agric., Trinidad and Tobago, Port of Spain*, xiv, no. 6, 1915, p. 199.

Analyses of locusts carried out in Trinidad showed that their bodies are rich in nitrogen. In dry examples of *Tropidacris dux* a total of 96·5 per cent. organic matter contained 11·30 per cent. nitrogen, and in the case of *Schistocerca paranensis* 96·45 per cent. organic matter contained 12·18 per cent. nitrogen. The remaining ash was made up of 1·16 per cent. potash and 1·63 per cent. phosphoric anhydride in *T. dux*, and of 0·94 per cent. potash and 1·44 per cent. phosphoric anhydride in *S. paranensis*.

URICH (F. W.). **Insects affecting the Coconut Palm in Trinidad.**—*Bull. Dept. Agric., Trinidad and Tobago, Port of Spain*, xiv, no. 6, 1915, pp. 200–203.

Various insects attack coconut palms in Trinidad. *Rhynchophorus palmarum*, L. (gru-gru beetle) is attracted to trees which have been wounded or are suffering from fungoid or bacterial disease. The larvae are preyed upon by the larvae of an Elaterid and a Histerid.

Control measures include the tarring of wounds and the burning of cut branches. *Rhina barbirostris*, L. (bearded weevil) attacks unhealthy trees. The larvae are preyed on by the larvae of an Elaterid and parasitised by an undetermined Tachinid fly. Palms which have been burnt should have the charred parts cut out and should then be treated with crude oil, tar, or a stiff paste of white lime to which is added lead arsenate paste in the proportion of 5 lb. to 50 gals. lime. The so-called flaming of trees for disease should be discontinued. *Metamasius hemipterus*, L. (small weevil borer) is a secondary pest generally associated with *R. palmarum*, and has the same natural enemies. *M. obsoletus*, Gyl., *Xyleborus affinis*, Eich., and *X. confusus*, Eich. (shot-hole borers), are treated in the same way as *R. barbirostris*. *Strategus aloeus*, L. (rhinoceros beetle) attacks young palms by burrowing into the stem from the base upwards. The larvae are attacked by the green muscardine fungus and by *Cordyceps* sp. Breeding can be prevented by burning rotting stems. *Enema endymion*, Chev., *Phileurus didymus*, L., *Passalus interruptus*, L., and *Scalmus interstitialis*, Eich., are also recorded pests.

Brassolis sophorae, L. (coconut butterfly) may become a serious pest when not checked by natural enemies. The latter include an undetermined egg-parasite, a Tachinid parasite of the larva and a Chalcid parasite of the pupa. The insect can be controlled by burning the nests of the larvae and by spraying with lead arsenate in the proportion of 4 lb. to 50 gals. water. *Castnia licus*, Drury (giant moth borer) feeds on the soft tissues of the developing fronds. Attacked leaves usually turn yellow, and the larvae, which are found at the base, can be cut out and the wound treated with tar or crude oil. *Sibina modesta*, Cram., *Automeris liberia*, Cram., *Hesperus* sp., and *Tortrix* sp., occur occasionally on the coconut.

The scale-insect *Aspidiotus destructor*, Sign., is associated with the ant *Azteca chartifex* and may cause serious injury to mature trees. It is attacked by a Hymenopterous parasite and by the predaceous Coccinellids, *Azya trinitatis*, Mshl., and *Cryptognatha nodiceps*, Mshl. The nests of the ants should be cut out of the stem and the wounds painted with crude oil or tar. The scales can then be sprayed with any insecticide. *Icerya montserratensis*, Riley and Howard (Montserrat fluted scale), *Vinsonia stellifera*, Westw. (star scale), *Pinnaspis buxi*, Bouché (long scale), *Pseudococcus nipae*, Mask. (yellow mealy bug), have also been met with on coconuts. The last-named is associated with an ant, *Camponotus* sp.

The following Aleurodids occur in small numbers :—*Dialeurodicus pulcherrimus*, Quaint. and Baker, *Dialeurodicus* sp., *Aleurodicus cocois*, Curtis, *A. trinidadensis*, Quaint. and Baker, *Aleurodes* sp., and *Paraleurodes* sp. *Heliothrips haemorrhoidalis*, Bch., is occasionally found on the leaves. The leaf-cutting ant, *Atta cephalotes*, L., occasionally defoliates young plants and *A. octospinosa*, Gunther, removes the male flowers. *Eutermes* sp. and *Calotermes* sp. breed in decayed portions of the trunk. *Tropidacris dux*, L. (giant grasshopper) has been occasionally recorded on coconut.

BIRT (A. G.). **The Cultivation of Sugar-cane.** *Dept. Agric., Assam*, Bull. no. 1, 1915, 6 pp. [Received 3rd January 1916.]

The most common insect pests of sugar-cane in Assam recorded in this bulletin are two species of moth-borers. The larvae, hatching from eggs deposited on the young shoots, bore downwards in the stem. Pupation takes place outside the host plant. The shoots may die as the result of attack or may give rise to new lateral branches. Canes injured by borers do not ripen properly and contain less sugar than healthy plants. The numbers of the insect can be materially lessened by the collection of egg-clusters and by the destruction of rubbish after the harvest.

Summarising Report on Locust Work for the Second Quarter—April 1st to June 30th 1915.—*Agric. Bull., Fed. Malay States, Kuala Lumpur*, iv, no. 1, October 1915, pp. 13–20, 2 tables. [Received 3rd January 1916.]

During the first half of the year 197 swarms of locusts were dealt with in Selangor as against 1,241 for the same period in 1914. In the Negri Sembilan an increase of 408 swarms was recorded, which is probably due to an extended use of poison, accompanied by improved efficiency, rather than to an actual increase in the number of locusts present in the State. In the Negri Sembilan the problem of exterminating the locusts has been reduced to the question of controlling the hoppers produced in large numbers in the lalang lands around Tampin. The destruction of the swarms prevented the locusts from damaging crops during the first half of the year.

DUTT (H. L.). **The Campaign against Surface Caterpillar at Mokameh in 1914-15 (Fifth Report).**—*Agric. Jl., Dept. Agric., Bihar and Orissa, Patna*, iii, no. 1, April 1915, pp. 1–14, 3 plates, 3 tables. [Received 7th January 1916.]

The campaign against *Agrotis ypsilon* during 1914–15 was conducted with 34 improved traps on the same lines as in previous years. The work was begun at the end of August under normal conditions, the traps being placed as soon as the flood water began to fall. Sowing operations were completed by the third week in October. The season was characterised by an abnormal drought. The first report of damage was received from Daurapur on 15th October; injury continued up to the middle of November, being helped by the weather conditions which considerably weakened the crop. The area damaged was considerable, but in view of the drought throughout the season, the result of the campaign was considered satisfactory. The largest number of moths was caught in October, after which there was another rise in the catches in November. In December the catches continued low. In six traps left after 4th January the catches increased in February and declined again during March, when the experiments were discontinued. As the result of an experiment conducted in October, beer was substituted for alcohol and ethyl acetate in the bait liquid and later was replaced by country liquor, which was found to be equally effective. In order to ensure complete success, a large number of traps must be used, so that the whole of the infested area may be brought under control.

No new light has been thrown on the question of aestivation. The arguments in favour of the theory of local hibernation are as follows:—(1) The fact that the same area is attacked year after year probably indicates that the pest is of local origin and not a migrant. (2) The fact that in a fresh area the attack gradually increases in extent and intensity year by year seems to support the view that the insect is local. Observations tend to show that the insect may at first migrate to a suitable locality, which then becomes the permanent breeding ground, the progeny of the first-comers gradually extending to a wider tract of land. (3) The first catches of the season do not have the appearance of having travelled a long distance. (4) A distinct interval occurs between broods in two contiguous *tals* [see this *Review*, Ser. A, iii, p. 320].

During the last four campaigns a gradual increase in the proportion of males to females has been noted. Examination of moths for egg-contents showed that the percentage of gravid females full of eggs was higher in the first few months than in December or November. It would appear that in *Agrotis* the attraction for Andrès Maire traps is stronger than the egg-laying instinct. This fact has an important bearing on the successful issue of the campaign.

DUTT (H. L.). **The Soy Bean Stem-Borer.**—*Agric. Jl., Dept. Agric., Bihar and Orissa, Patna*, iii, no. 1, April 1915, pp. 52-56, 3 figs. [Received 7th January 1916.]

A Cerambycid beetle, *Nupserha* sp., has caused considerable damage during the past three years to an experimental plot of soy beans at Sabour. The adult insect is nocturnal in habit. When ovipositing, the female selects a young green shoot which it girdles at two points about half an inch apart and from 2 to 2½ inches from the apex. The eggs are laid singly in the pith 2 or 3 mm. above the lower girdle. The buds and leaves above the girdles begin to droop in four or five days and finally die. The incubation period is nine or ten days. The larva on hatching tunnels along the pith, generally towards the main stem. The larval stage lasts more than six weeks, pupation taking place in a cell in the tunnel. The adult emerges in about eight days through a hole made in the stem. The larva hibernates inside the stem of the host plant, emergence from hibernation probably taking place after April. Attack is first noticed in the field in May or June on self-sown soy bean plants. On the regular crops, injury appears in July, when the plants are from 9 to 12 inches high. The insect is active throughout the rains until harvest, there being probably three broods annually. In controlling the insects, affected twigs should be picked off and destroyed within two or three days of egg-laying. After the harvest, the land should be ploughed and the dry stubble burnt to kill hibernating larvae. Broken branches should be collected from the threshing floor and burned.

BRITTAIN (W. H.). **The Green Apple Bug on Apples and Pears.**—*Canadian Horticulturist, Peterboro, Ont.*, xxiii, no. 12, December 1915, pp. 269-270, 4 figs.

Lygus invitus (false tarnished plant bug) is distributed throughout the fruit-producing centres of the Annapolis Valley of Nova Scotia.

So far as can be determined, the insect breeds only on apple and pear. It has been found on plum in the adult stage, but probably does not lay eggs on this plant. The eggs are laid beneath the bark of the twigs and begin to hatch a few days before the blossoms open. The winged insects appear from 31 to 34 days after hatching. In feeding, the young insects prefer the young leaves of apple and pear, but also puncture the twigs. Later, they attack the blossoms and fruit exclusively. Both adults and young are very active. Injury to twigs results in the exudation of gum and the later development of a lump at the point of puncture, accompanied in severe cases by a cracking of the bark. The flowers usually dry up and fall to the ground. Injury to fruit results in distortion and hinders development. Pears show characteristic corky scars at the point of puncture. In plums, the seat of injury is usually at the extremity of the fruit further from the stalk and leads to the exudation of gum. Certain varieties of fruit are more susceptible to attack than others, and there is a tendency in an orchard for the insect to spread from the more susceptible to the less susceptible varieties. The most suitable conditions for increase are shady orchards with closely planted trees and a certain amount of herbage on the ground. Experiments have shown that insects which fall to the ground are capable of feeding and developing on timothy, red clover, couch grass, dandelion, etc. Remedial measures suggested are:—(1) spraying with Blackleaf 40, 1 pt. to 100 gals. water, just before and after the blossoms fall, and again five days later; (2) banding the trees with tanglefoot; (3) clean cultivation; and (4) thorough pruning and thinning out of trees.

GIBSON (A.). **Common Vegetable Crop Insects and their Control.**—*Canadian Horticulturist, Peterboro, Ont.*, xxiii, no. 12, December 1915, pp. 271–272.

Poisoned bran mash is recommended for use against cutworms, 20 lb. bran being enough for 3 acres. The bait should be scattered in the early evening. The importance of keeping down weeds in which the larvae may hibernate is emphasised. Experiments recently conducted to find a spray to kill the onion maggot fly [*Hylemyia antiqua*] showed that sodium arsenite, 5 grains in 1 gal. water, mixed with 1 pt. molasses, is effective. Applications of white hellebore, 2 ozs. in 1 gal. water, pyrethrum powder or mixtures containing borax, are also effective in destroying the eggs and young larvae. Land in which white grubs [*Lachnosterna*] are present should be ploughed as soon after the middle of July as is practicable.

CAESAR (L.). **Poison Sprays and Poison Baits in their Relation to Bees.**—*Canadian Horticulturist, Peterboro, Ont.*, xxiii, no. 12, December 1915, pp. 275 and 278, 1 fig.

In the opinion of the author, nearly all the recorded cases of poisoning of bees are due to the spraying of fruit trees with a poisonous solution while they are in full bloom. Sweetened arsenical sprays are used against two species of cherry fruit flies and against apple maggot [*Rhagoletis pomonella*]. For the fruit flies, two applications are

made, the first when the flowers are beginning to show pink, the second two weeks later. For the apple maggot, three applications are made if the season is wet, and two if it is dry, the first being made in July, the second early in August. Cherries and apples are not sprayed when nearly ripe. Where molasses has been added to the poison, no injury to bees has been recorded, although the insects have been attracted in certain cases in which sugar has been used. The Kansas remedy for cutworms and grasshoppers has been shown to have no attraction for bees.

TOWER (D. G.). **Biology of *Apanteles militaris*.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 12, 20th December 1915, pp. 495-507, 1 fig., 1 plate.

A study of the life-history of *Apanteles militaris*, Walsh, a Braconid parasite of *Cirphis* (*Heliophila*) *unipuncta*, Haw. (army worm), was carried out by the author at La Fayette, Ind., beginning in September 1914. The average duration of the egg-stage was 5½ days, and that of the three larval instars about 11 days. The larva emerged from the host at the termination of the second moult. The pupal period, which is passed in a cocoon, averaged 9 days, the total length of the life-cycle in September and October averaging 25 days. The ovipositions in the larvae of the host in the third stage were the most successful. In the laboratory from 8 to 72 eggs were deposited in one oviposition of less than one second, and in one case of four ovipositions 210 eggs were deposited in the same host. The parasitic larvae usually emerged after the host larva was full grown. Unfertilised eggs gave rise to males. Attempts to induce the parasite to winter in the cocoon were unsuccessful, though at Nashville, Tenn., it was found by Mr. G. G. Ainslie that *C. unipuncta* passed the winter in the immature larval stage, and that when the specimens under observation were parasitised in the autumn, the parasites completed their growth and emerged in the spring. In Canada *C. unipuncta* also hibernates in the larval stage. It is suggested that in the north the parasites winter as partly developed forms in immature larvae, while in the south they probably winter in the cocoon.

PARROTT (P. J.) & FULTON (B. B.). **Cherry and Hawthorn Sawfly Leaf-Miner.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 12, 20th December 1915, pp, 519-528, 1 plate.

As a cherry pest, *Profenusa collaris*, a sawfly leaf-miner, is known to occur in orchards of English Morello cherry about Geneva in western New York and at Germantown in the Hudson Valley. As these two districts are widely separated, this pest probably also occurs in other localities in which sour cherries are extensively grown. It is not known to occur as a cherry pest outside the State of New York, but injury to hawthorn by this insect has been recorded from various localities in New York State and from Boston, Mass. The attack of the sawfly larva begins on the edge of the leaf toward the stem and continues towards the apex. When this is reached, the direction of the tunnel is reversed. Usually from one-quarter to one-half of the total leaf area is destroyed. The principal damage occurs during the last week in May and the beginning of June. The leaves most seriously

injured drop to the ground. The destructive power of the insect is mainly directed to leaves which unfold with the bursting of the buds. Hawthorns are subject to more severe attacks than cherries, and in some seasons almost every leaf may be injured.

Adults begin to appear when the first leaf-clusters are unfolding. From puparia obtained from the soil beneath cherry trees on 18th April, adults emerged between 28th April and 2nd May. The latest date of emergence recorded in 1913 was 19th May. Pairing takes place within 24 hours after emergence. In the orchard eggs were observed on 7th May. The majority were found a short distance from the base of the leaf, in contact with the lower epidermis, from one to five eggs being found on a single leaf. During 1913, larvae were first observed on 24th May. In the insectary the period of incubation was 8 days, but under field conditions would probably be longer. When mature, the larva emerges from the leaf through the upper epidermis, and pupates in the soil. In 1912 about 50 per cent. of the larvae had abandoned the mines by 10th June. The pupa begins to form in the autumn and transformation is completed in the spring.

The eggs of *P. collaris* are parasitised to a considerable degree by a Chalcid, *Trichogramma minutum*, Riley. In 1915 parasitism ranged from 40 to 90 per cent. on individual trees. On 2nd June 1915, the parasites were all in the larval state; on 5th June, about 50 per cent. were in the pupal stage; on 9th June, the first adult appeared. An Ichneumon, *Pezoporus tenthredinarum*, has also been reared from *P. collaris*.

The most effective method of control of this leaf-miner is the picking of affected leaves, combined with the destruction of wild hawthorns in the immediate vicinity of a cherry orchard. Since it is the normal habit of the larvae of this sawfly to live in earth cells for the greater portion of the life-cycle of the species, measures such as autumn or early spring ploughing or cultivation are recommended. For the protection of decorative hawthorns, they should be sprayed with nicotine solution, 1 pt. nicotine (40 per cent.) to 100 gals. water, to which are added 4 lb. soap. The liquid should be applied when the insects first begin to mine the leaves.

de Joannis (J.). **Observations sur le *Carpocapsa* des châtaignes (Lep.).** [Observations on the *Carpocapsa* of chestnuts.]—*Bull. Soc. Entom. France, Paris*, no. 17, 10th November 1915, pp. 271–276, 1 fig. [Received 3rd January 1916.]

Early in October 1914, chestnuts were found to be infested with what is believed to be *Cydia (Carpocapsa) splendana*, Hb. Infestation is characterised by deformation of the nuts. Adults emerged in July from chestnuts collected in the previous October.

Paoli (G.). **Contributo alla conoscenza delle Cocciniglie della Sardegna.** [A contribution to the knowledge of Sardinian Coccids.]—Separate, dated 30th November 1915, from *Redia, Florence*, xi, pp. 239–268, 23 figs.

This paper records 47 species of Coccids from Sardinia, of which two are described as new, viz:—*Micrococcus oviformis* from the nests of *Messor barbarus*, L., and *Eulecanium (Lecanium) ficinum* on the bark of *Ficus carica*.

Destrucción de Plagas. [Pest destruction].—*Bol. Minist. Agric., Buenos Aires*, xix, nos. 8–9, August–September 1915, pp. 523–525. [Received 5th January 1916.]

In the Argentine, 91,581 ants' nests and 14,959 kilos of bagworms were destroyed in June 1915, and 115,333 ants' nests and 22,173 kilos of bagworms in July. The inspection measures against *Aulacaspis pentagona* showed that the number of infested plants was 192,265. In August, 113,240 kilos of winged locusts were destroyed.

LUNA (F.). **Experiencias sobre resistencia del manzano a la desinfección por el ácido cianhídrico.** [Experiments on the resistance of the apple to disinfection by hydrocyanic acid gas.]—*Bol. Minist. Agric., Buenos Aires*, xix, nos. 8–9, August–September 1915, pp. 557–568, 11 figs. [Received 5th January 1916.]

Since 1913 the Sanitary Office for Imported Plants and Seeds has possessed three ferro-concrete fumigation chambers, and the present experiments were made in them. For deciduous plants the following formula was used: Water, four parts by weight; sulphuric acid, two parts, and potassium cyanide (98%–99% pure), one part. About half an ounce of cyanide was used per 40 cubic feet. This dose was halved for non-deciduous plants and an even weaker one was used for very tender ornamental growths. The plants were taken up, fumigated and then re-planted in a different spot. It was found that apples, pears and quinces may be fumigated with maximum doses of hydrocyanic acid gas, and though they suffer from the necessary transplanting, the effect of the gas is nil as regards subsequent flowering and fruit-bearing.

CHILABERT (J. B.). **Instrucciónes para combatir la langosta.** [Instructions for controlling locusts.]—*Bol. Dept. Nacional Fomento, Asuncion, Paraguay*, ii, nos. 8-9, January-June 1915, pp. 61–66. [Received 7th January 1916.]

This paper gives instructions for dealing with an invasion of locusts. The plan of operations is outlined and a number of the usual control methods are enumerated.

CALDAS (D.). **Un acarina parasito da batata.** [An Acarine parasite of the potato.]—*Chacaras e Quintaes, S. Paulo*, xii, no. 6, 15th December 1915, p. 434, 1 fig.

At Bahia the Early Rose variety of potato was found to be attacked by the mite, *Tetranychus bimaculatus*, Harvey. Spraying with lime-sulphur is the control advised.

LAINES (M.). **The most effective scientific means of combating the grasshopper.**—*Revista Económica, Tegucigalpa, Honduras*, v, no. 5, November 1915, pp. 268–270. [Received 20th January 1916.]

This paper deals with the culture of *Coccobacillus acridiorum*, d'Hérelle, the exaltation of its virulence, and the preparation of bouillon for spraying areas invaded by grasshoppers. The bouillon

is prepared as follows: A pound of beef is macerated for 24 hours in $1\frac{3}{4}$ pint of water; 3 per cent. of peptone and 5 per cent. of sodium chloride are then added. The liquid is then filtered, rendered alkaline and sterilised. Twelve hours after the bouillon has been infected, the presence of the *Coccobacillus* in the bouillon should be verified and some of it taken up into a sterilised hypodermic syringe and one drop injected into a grasshopper. This is done with forty or fifty individuals, which are then shut up in a wire cage with sufficient food. Death occurs within thirty hours, but the dead bodies of individuals which have died in a shorter time than fifteen hours should be removed from the cage, so that only those which succumb in from fifteen to thirty hours remain. The abdominal substance which is extracted from them should show a dark coloration and will be used to inject another lot of forty or fifty grasshoppers, after diluting it with sterilised water. It should be examined under the microscope for the presence of the coccobacillus and a special cultivation should be made in in agar-agar, consisting of bouillon, 1,000 grammes; agar-agar, 3 grammes. These operations of infecting various series of grasshoppers should be continued till the virulent exaltation of the coccobacillus is obtained; the abdominal substance of the grasshoppers of the last series is then taken and diluted with sterilised water. After two cultivations in agar-agar, the coccobacillus is ready for introduction into the bouillon used for spraying, which consists of:—Water, 1,000 grammes; peptone, 30; gelatine, 25; glucose, 5; and sodium chloride, 5. This bouillon should be sprayed at fixed times in the invaded areas.

Zhitkov (Gr.). **О результатахъ искусственнаго облѣсенія вырубокъ въ Фащевскомъ Опытномъ Лѣсничествѣ послѣ временнаго, предварительнаго сельско-хозяйственнаго пользованія.** [On the results of afforestation of clearings in the Fashtchev Experimental Forests after temporary agricultural use.]—**«Лѣсная Жизнь и Хозяйство.»** [*Forestry Life and Economy*], *Tambov*, iv, no. 6, 1915, pp. 6–12.

The utilisation of clearings for agricultural purposes before re-afforestation is useful in many respects; it clears the soil of weeds, renders it friable, thus assisting the accumulation of moisture, and causes a decrease in the numbers of the larvae of *Melolontha*. Observations in this forest during recent years have shown that from June to August the larvae, particularly those of the first year, live at a depth of about 4 inches, and are thus readily brought to the surface by the plough. In many experiments, larvae subjected for from 10 to 15 minutes to the effect of sunlight were not able to work their way back into the soil, even under the most favourable conditions for this process. Thus the agricultural use of clearings may be of considerable importance in the control of these pests, and the cost of this measure is usually more than covered by the profits from the crops obtained.

KVIATKOVSKY (S. I.). **Докладъ о результатахъ искусственнаго облѣсенія вырубокъ послѣ сельско-хозяйственнаго пользованія въ Лебедянскомъ лѣсничествѣ.** [Report on the results of the afforestation of clearings after their agricultural use in the Lebedjansk Forests.]—**«Лѣсная Жизнь и Хозяйство.»** [*Forestry Life and Economy*], *Tambov*, iv, no. 6, 1915, pp. 13–16.

Some clearings in this forest were under agricultural cultivation for six years (1907–1914) and in 1914 and 1915 they were replanted with pine-trees. The number of larvae of *Melolontha* remaining in the soil appears to have decreased considerably and the loss to the seedlings from them amounted to only about 2 per cent. The clearings in question were made in 1890, and up till 1906 all attempts to re-afforest them proved fruitless.

Труды десятаго совѣщанія агрономовъ при Екатеринославской Губериской Земской Управѣ 4-го октября 1915 года. [Proceedings of the 10th Conference of Agronomists with the Executive of the Zemstvo of the govt. of Ekaterinoslav, on the 17th October 1915.—Published by the Zemstvo of the govt. of Ekaterinoslav], *Ekaterinoslav*, 1915, 59 pp.

The two following papers on Entomology were read and discussed at the Conference:—

(1). VITKOVSKY (N. N.). **Вредители муки и зерна въ Екатеринославской губерніи по наблюденіямъ текущаго года.** [Pests of grain and flour in the govt. of Ekaterinoslav, as observed in the current year], pp. 44–55.

The following insect pests were observed in the grain stores during 1914:—*Calandra granaria*, L., *Tenebrio molitor*, L., *Tribolium confusum*, Duv., *Silvanus surinamensis*, L., *Laemophloeus testaceus*, L., *Tenebrioides mauritanicus*, L., *Ephestia kühniella*, Zell., *Plodia interpunctella*, Hb., and *Pyralis farinalis*, L. The most injurious were *C. granaria* and *E. kühniella*. The former attacked wheat, rye and barley, especially the last-named. In grain stored in sacks only a portion of the weevils are able to escape and return again, a great many of them perishing in the sacking. In grain stored in bulk they do not penetrate deeper than about 2½ feet, owing to the pressure at greater depths. A striking illustration of this was observed in one warehouse where a quantity of barley which had been stored for 12 years showed no signs of injury lower than 2½ feet, while the upper strata were full of various insects, including *C. granaria*. Although this last fact tends to decrease the rates of possible damage given by A. I. Strachov-Koltchin [see this *Review*, Series A, iii, p. 488], *C. granaria* is a serious pest and, owing to the present scarcity of carbon bisulphide in Russia, preventive remedies must be widely applied. Grain containing more than 13½ per cent. of moisture should not be accepted, and all grain should be stored in closed warehouses which can be frequently ventilated.

Ephestia kühniella, Zell., about which little has been published in the Russian language, does great damage to flour. It is a common insect in mills, where, owing to the high temperature, the hibernating females occur throughout the winter. According to the statements of millers, their numbers are so great that their webs frequently obstruct the free passage of the flour through the hoppers and it becomes necessary to take the hoppers to pieces and clean them, while the workmen are able to earn a fair income by selling the caterpillars at 4s. per lb. as food for cage-birds. In unheated mills, the adults of the first generation appear in May and the second in August. It is probable that there is a partial third generation, which however perishes in cold stores and premises, the usual hibernating stage there being that of caterpillar and egg. A parasite, not yet identified, has been observed to destroy large numbers of the caterpillars in August and September. The only practical remedy, other than fumigation with carbon bisulphide, consists of passing the flour through sieves, when the first cold sets in, and removing it immediately afterwards from the mill storehouses.

(2). Averin (V. Gr.). **Краткія свѣдѣнія объ амбарномъ долгоносикѣ и мѣрахъ борьбы съ нимъ.** [A short account of *Calandra granaria* and its control], pp. 56–59.

The paper gives a summary of the life-history and control of *Calandra granaria*, L., and also a list of 12 papers on it by various authors, of which several have already been dealt with [see this *Review*, Series A, ii, pp. 39, 213, 502; A, iii, pp. 487 and A, iv, 22]. The necessity of beginning experiments on control by means of hydrocyanic acid gas is urged, and a resolution to that effect was passed by the Conference.

Kulagin (Prof. N. M.). **Насѣкомыя, вредныя для полевыхъ культурныхъ растеній въ Европейской Россіи въ 1914 году.** [Insects injurious to cultivated field-plants in European Russia in 1914.] —**«Извѣстія Московскаго Энтомологическаго Общества.»** [*Bulletins of the Moscow Entomological Society*, (*Societa Entomologica Mosquensis*)], *Moscow*, vol. i, 28th November 1915, pp. 136–161. [Received 27th January 1915.]

This tabulated summary, which is compiled from the district reports, includes the following insect pests:—

Coleoptera: *Zabrus blaptoides*, Dej. (wheat), *Z. tenebrioides*, Goeze (wheat), *Ophonus calceatus*, Duft. (Italian millet), *Blitophaga undata*, Müll. (barley and wheat), *Meligethes aeneus*, F. (wheat, rape, *Salix*, *Caltha* and *Viola*), *Omophlus lepturoides*, F. (rye), *Podonta nigrita*, F., *Opatrum sabulosum*, L., *Gonocephalum pusillum*, F., *Crioceris merdigera*, L. (asparagus and onions), *Lema melanopa*, L., *Chaetocnema hortensis*, Geoffr., *Psylliodes attenuata*, Koch (hemp), *P. luteola*, Müll., *Haltica euphorbiae*, F., *H. oleracea*, L., *Cassida nebulosa*, L., *Bruchus pisorum*, L. (*pisi*), *Otiorrhynchus ligustici*, L., *Sitones lineatus*, L., *Baris chloris*, F., *Apion pomonae*, F. (pears and vetches), *A. craccae*, L., (vetches and oats), *Melolontha melolontha*, L. (winter crops), *Anisoplia austriaca*, Hbst., *A. crucifera*, Hbst.,

A. segetum, Hbst., *A. cyathigera*, Scop., *A. agnata*, Reitt., *A. farraria*, Er., *Epicometis hirta*, Pod. (rye), *Oxythyrea funesta*, Pod. (wheat), and *Pentodon idiota*, Hbst.

Lepidoptera: *Ochsenheimeria taurella*, Schiff., *Talis quercella*, Schiff., *Phlyctaenodes sticticalis*, L., *Pyrausta nubilalis*, Hb. (hemp, millet, maize, mustard and sunflower), *Acronycta rumicis*, L., *Phytometra (Plusia) gamma*, L., *Trachea (Hadena) basilinea*, F., *Hydroecia nictitans*, Bkh., *Oria (Tapinostola) musculosa*, Hb., *Euxoa tritici*, L. (winter-sown crops), *E. segetum*, Schiff., *Feltia exclamationis*, Schiff., and *Episilia (Agrotis) simulans*, Hüfn.

Hymenoptera: *Cephus pygmaeus*, L., *Athalia colibri*, Christ. (*spinarum*, F.), and *Bruchophagus gibbus*, Boh. (seed-clover).

Diptera: *Hylemyia (Leptohylemyia) coarctata*, Fall., *Opomyza (Agromyza) florum*, F., *Oscinella frit*, L., *Chlorops taeniopus*, Meig., *Mayetiola (Cecidomyia) destructor*, Say, and *Lasioptera cerealis*, Lind. (rye and barley).

Rhynchota: *Aelia acuminata*, L., *Eurygaster maura*, L., *E. integriceps*, Put., *Trigonotylus ruficornis*, Geof., *Adelphocoris lineolatus*, Goeze, *Macrosiphum granarium*, Kirby, *Pentaphis trivialis*, Pass., *Toxoptera graminum*, Rond., *Tetraneura rubra*, Sich., and *Brachycolus noxius*, Mordw.

Orthoptera: *Locusta (Pachytylus) migratoria*, L., *L. danica*, L., and *Calliptamus italicus*, L.

Thysanoptera: *Anthothrips aculeatus*, F., *Haplothrips tritici*, Kurd., *Stenothrips graminum*, Uzel, and other species of thrips.

Separate lists of pests of beet [see this *Review*, Series A, iii, p. 541] and of mustard [see this *Review*, Series A, iii, p. 398] are also given. A list of reports dealing with insect pests in 1914 is appended, the majority of which have already been abstracted [see this *Review*, Series A, ii, p. 712, iii, 41, 93, 98 (two papers), 105, 203, 309, 339, 395, 398 (two papers), 442, 479, 541, 600, 634, 638, 641, 642 and 700].

Rossikov (K. N.). **Бабочка Боярышница и новый способъ борьбы съ ней.** [*Aporia crataegi*, L., and a new method of controlling it.] — **«Защита растеній отъ вредителей.»** [Protection of plants from pests], no. 5 (27), Supplement to **« Любитель Природы.»** [*Friend of Nature*]. *Petrograd*, 1915, 18 pp., 5 figs, 2 plates.

The author advises that remedies against *Aporia crataegi* should be directed against the adults rather than against the early stages, as these frequently involve the destruction of their parasites. The food-plants of this pest include many fruit and forest trees, such as plum, cherry, apple, pear, apricot, medlar, marsh elder (*Viburnum opulus*), service tree, bird cherry, sloe and many others. This butterfly is spread all over Europe and also occurs in Caucasia, Turkestan and Siberia. Outbreaks of it frequently occur in Russia, one of the earliest known being that recorded by Pallas in 1769 on the Volga. Some birds, especially sparrows, destroy this insect, and it has numerous Hymenopterous parasites, including the Ichneumonids, *Theronia flavicans*, F., *Pimpla rufata*, Gr., *P. varicornis*, Gr., *P. instigator*, F., and the Braconids, *Apanteles glomeratus*, L., and *A. spurius*, Wesm., which attack either the caterpillars or pupae, while the author has also bred a Hymenopterous parasite from the eggs.

Nine species of Diptera are known to parasitise the caterpillars, including the Tachinids, *Lydella nigripes*, Fall., *Phorocera assimils*, Fall., and *Phryxe vulgaris*, Fall. The great importance of these parasites is demonstrated by a number of examples.

The usual remedies include the collection of the winter nests and spraying with Paris green, azurgin, arsenic, barium chloride and other insecticides. The destruction of the nests is the most effective of these, but care must be taken not to interfere with the parasites, which involves some trouble and is not always practicable. The author prefers to take advantage of the attraction which the flowers of borage, *Borago officinalis*, and especially those of various kinds of onion, have for the adults. On these flowers the butterflies can easily be collected by hand even in the day time. On one occasion one man was able to collect nearly 3,000 adults in an hour in this way. The author therefore recommends the sowing of beds of onions flowering in May and June, which will serve as traps. The effect of destroying large numbers of *Aporia crataegi* will be to compel the parasites, many of which are not confined to one host, to attack other pests, such as *Pieris brassicae*, *P. rapae*, *P. napi*, *Malacosoma neustria*, *Lymantria dispar*, *Euproctis chrysorrhoea*, etc.

LUTCHNIK (V. N.). **Турнепсовый или рапсовый пилильщикъ.** [The turnip or rape sawfly (*Athalia colibri*, Christ.).]—« **Хозяйство.**» [*Husbandry*], *Kiev*, x, nos. 45–46, 10th December 1915, pp. 1060–1063.

Of late years the utilisation of swampy land for agricultural purposes has largely increased in South Western Russia and the author has investigated the pests of crops on such land on one estate in the government of Minsk. One of the pests found there is *Athalia colibri*, Christ. (*spinarum*, F.). It is found in Europe, Western Asia and North America, and in Russia is common in the South as well as in North Caucasia, Transcaucasia and Western Siberia, having been found as far north as Moscow. The larvae occur on turnips, rape, radish, mustard, charlock and other Cruciferae, both wild and cultivated. The imagines appear in May and June, and the females deposit their eggs beneath the epidermis of the under side of the leaves. The larvae emerge in from 5 to 7 days and devour the parenchyma of the leaves; the number of generations varies from two to three; pupation takes place in the earth and lasts from 11 to 18 days, the last generation wintering in that stage. Careful weeding, trap-crops in spring, spraying with Paris green ($\frac{1}{2}$ lb. of green, 1 lb. of quick lime, and $\frac{1}{2}$ lb. of soft soap, in about 35 gallons of water) or barium chloride, djipsin, arsenic, and arsenite of lime are recommended. Soft soap is effective only against the very young larvae.

Распоряженiе о признанiи Туркестанскаго края благополучнымъ по филоксерѣ. [An order declaring the province of Turkestan to be free from Phylloxera.]—« **Извѣстiя Министерства Земледѣлiя.**» [*Bulletins of the Ministry of Agriculture*], *Petrograd*, no. 49, 19th December 1915, p. 1198.

This is an order by the President of the Central Board of Land Administration and Agriculture declaring the whole of Russian Turkestan to be free from *Phylloxera* and prohibiting the importation into that province of vine plants or parts of them from other vine-growing districts of Russia and from abroad.

V-v (I.). **Россійское Общество дѣятелей по прикладной энтомологіи.** [The Russian Society of Economic Entomologists.]—**«Южно-Русская Сельско-Хозяйственная Газета.»** [*South Russian Agricultural Gazette*], *Charkov*, xvii, no. 47, 23rd December 1915, pp. 9-19.

This is a short report on the inaugural meeting of the Russian Society of Economic Entomologists, which took place in Kiev on 4th December, 1915 [see this *Review*, A, iii, p. 245]. Professor V. P. Pospielov was elected president, and Professors I. N. Wagner and I. V. Emelianov, vice-presidents, the council of the Society also including A. G. Lebedev, S. A. Mocrzecki and V. V. Dobrovliansky, the secretary. It was resolved to publish an organ under the title "Journal of Applied Entomology," the joint-editors of which are to be A. G. Lebedev, I. V. Emelianov and V. V. Dobrovliansky.

D. V. **Совѣщаніе по вопросу объ обезпеченіи запасовъ зерна и муки отъ зараженія амбарнымъ долгоносикомъ и другими вредителями.** [Conference as to the means of protecting stores of grain and flour against infestation by *Calandra granaria* and other pests.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, x, nos. 47-48, 24th December 1915, pp. 1093-1095.

The papers read and discussed at this conference are only shortly referred to. One by Professor M. Vassiliev recorded the rearing from grain infested with *Calandra granaria* of a parasite of the latter, *Lariophagus* (*Pteromalus*) *distinguendus*, Först. In another paper, the same author recommended poisoning this weevil by placing cups containing a solution of barium chloride in infected stores. In a paper by E. V. Zvierezomb-Zubrovsky, it was pointed out that many pests of grain live underneath the floors of the stores.

The conference decided (1) that it is necessary to organise the manufacture of carbon-bisulphide in Russia, (2) that the Russian Society of Economic Entomologists be invited to inquire into the question of the admissible maximum percentage of infection of grain, and (3) of the best methods of disinfecting stores, (4) that sacks of infested grain must be disinfected before further use, and (5) that railway warehouses should not be used for storing grain for the Army until they have been approved by expert entomologists.

Sokolov (N.). **Посѣщается ли аконитъ насѣкомыми?** [Is the plant aconite visited by insects?]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing and Market-gardening*], *Petrograd*, xii, no. 51, 2nd January 1916, p. 1347.

The author disagrees with the statement by Gomilevsky [see this *Review*, Series A, iv., p. 58] that *Aconitum napellus* is never visited by insects, as he has observed a Lepidopterous caterpillar feeding on this plant. The flowers are also visited by bumble bees, which are greatly attracted by them, and though they become intoxicated by so doing, do not appear to be permanently affected.

SERBINOV (I. A.). **Войлочная болѣзнь и бѣль листьевъ груши.** [Erinosis and "white leaf" of pears.] **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing and Market-gardening*], *Petrograd*, xii, no. 51, 2nd January 1916, p. 1351.

In reply to a subscriber it is pointed out that the leaves of pears sent by him are infested with the mite, *Eriophyes pyri*, Pgst., which causes the disease frequently mistaken for that due to the fungus, *Fusicladium pyrinum*. These mites cause the formation of thick, yellow or red scales on the lower surface of the leaves and are only dangerous when they are so numerous as to bring about the withering and dropping of the foliage. The removal and destruction of the damaged leaves and spraying with kerosene emulsion before the unfolding of the buds, in which the pests winter, are recommended. These mites also attack service trees, *Cotoneaster*, dogwood and quince.

OI (I. A.). **Поврежденіе листьевъ лавра насѣкомыми.** [An Insect injuring leaves of Laurels.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-growing and Market-gardening*], *Petrograd*, no. 52, 9th January 1916, p. 1387.

In reply to a subscriber, it is stated that the leaves of *Laurus nobilis*, L., sent by him, are infested with the Psyllid, *Trioza alacris*, Flor, attacks of which cause curling of the leaves. The removal and destruction of the infested leaves is the only known remedy; seedlings should be disinfected, if necessary, with carbon bisulphide or hydrocyanic acid.

SILVA FIGUERA (C.). **Un nuevo microlepidóptero chileno que causa perjuicios a las papas.** [A new Microlepidopteron causing injury to potatoes.]—*Rev. Chilena Hist. Nat., Santiago de Chile*, xix, nos. 1–2, January–April 1915, pp. 41–42, 1 fig. [Received 26th January 1916.]

This note records the discovery in Chili of a new Microlepidopteron injuring potatoes quite as badly as, if not worse than, *Gelechia galbanella*, Zell.,* which was present in company with it; it has been named by Mr. Klunder van Gyen, *Dichomeris* (*Trichotaphe*) *tangolias*.

FRYER (J. C. F.). **Capsid Bugs.**—*Jl. Bd. Agric., London*, xxii, no. 10, January 1916, pp. 950–958, 2 plates.

Damage to fruit trees by Capsid bugs is well known in the United States and Canada. Attack on apples in Britain was first recorded in 1910, since which date several other records have been made. A census of the bugs found in affected orchards seems to show that the green Capsids, *Plesiocoris rugicollis* and *Orthotylus marginalis*, cause most of the damage, and that of these *P. rugicollis* is the more injurious. The brown Capsids, *Psallus ambiguus* and *Atractotomus mali*,

[*As this species is a European one, only known to feed on moss, this is probably a mistake for the well known *Phthorimaea operculella*.—ED.]

are of secondary importance. *P. rugicollis* and *O. marginalis* are natives of Britain, occurring commonly in almost every English county. Both species seem to have accommodated themselves to apple as a food-plant within recent years, early records giving willow, sallow, alder and hazel as the hosts. Both species, and especially *P. rugicollis*, will attack red currant and cause a spotting of the leaves, but it is not known whether eggs are laid on this plant. Typical injury to apples has been recorded from Cambridgeshire, Suffolk, Kent, Sussex, Worcester, Hereford, Devon and Cornwall, though many clean orchards are found in infected districts. Attacked orchards have no common features of soil or situation, and no reason can be assigned for the presence of clean orchards in infected localities.

The habits of *P. rugicollis* have been studied. Egg-laying takes place from the end of June to the beginning of August. Eggs obtained in captivity were deeply embedded in the twigs at the base of the new growth and in the wood of the previous year. In the open, the eggs are laid singly, usually through the lenticels.

The eggs remain during the autumn and winter, and give rise to young bugs during the latter half of April, the earliest date recorded being 14th April. When first hatched, the young insects shelter in the opening leaf and flower buds. Later, they become active and puncture the leaves, twigs and young fruit. The area round each puncture shows serious injury; the leaves become covered with red or brown spots and the shoots are stunted and sometimes killed. The terminal shoot of each branch suffers most severely and there is, in consequence, an excessive production of lateral twigs. The skin of attacked fruit shows rough, discoloured areas. In severe cases, the fruit is very deformed, cracks appear at the positions of the original punctures, and the surface becomes corky. Such fruit generally falls when half grown. From 20 to 30 per cent. of the crop of an orchard may be rendered unfit for sale. Certain varieties of apples seem to be more liable to attack than others, but observations from different districts do not entirely agree.

It is as yet impossible to recommend any combined action among growers to prevent the spread of Capsids. The insects must be controlled in individual orchards as they appear. The best time to kill the bugs is soon after hatching. The best spraying fluids are nicotine and soap and certain proprietary insecticides. In America, Black Leaf 40 (nicotine sulphate) has been found most effective. The spray should be thoroughly applied during the last 10 to 14 days in April, or during the first week in May, according to the locality. After the bugs have grown considerably, they are very apt to fall from the trees if disturbed. It would seem probable that the use of winter-moth bands at this period is necessary if good results are to be obtained. When the period between hatching and the opening of the blossoms is sufficiently long, an attempt should be made to control the bugs at the earlier period.

Flea Beetles.—*Botanical Jl., London*, iv, no. 4, January 1916, pp. 49–50.

Phyllotreta nemorum (turnip flea-beetle) and *Haltica oleracea* (cabbage flea-beetle) are well-known in Britain. In the former species, the winter is passed in the adult stage, beneath the bark of trees, under

fallen leaves, etc. Emergence takes place in early spring. Pairing occurs from March to October; the eggs are laid beneath the epidermis of charlock or other Cruciferous plants. The larvae hatch in from 8 to 10 days, and tunnel in the mesophyll. Pupation takes place in the soil, the pupal stage lasting 2 weeks. The number of generations produced in one season varies from 3 to 6, according to weather conditions. The adults cause serious damage to root crops, young seedlings, and to the mature leaves of cabbage, horse radish, rhubarb, etc. The life-history of *H. oleracea* differs from that of *P. nemorum* in that the eggs are deposited on the leaf surface; the larvae, in consequence, are not leaf-miners. Pupation occurs about 2 weeks after hatching. There are usually five broods a year. The adults feed upon wild and cultivated Cruciferae and upon *Epilobium* and *Oenothera*. In controlling these beetles, it is important to keep crops free from weeds, especially wild Cruciferae. Dead leaves, etc., should be burned in autumn. Spraying with an arsenical wash is useful against *H. oleracea*.

The Cold-water Cure for Woolly Aphis.—*Queensland Agric. Jl., Brisbane*, iv, no. 6, December 1915, pp. 331–332.

In this article the author states that he has been able to control woolly aphis [*Eriosoma lanigerum*] in an orchard by spraying the trees thoroughly with cold water four times during the summer (in December, January, February and March). Spraying is carried out just before the application of arsenate spray for the codling moth [*Cydia pomonella*], and after the process is finished, the soil beneath the tree is churned up with water in order to bury any Aphids that are washed off. It is suggested that more attention should be paid to this method of control and to the breeding and liberation of natural enemies than to the use of poisonous sprays.

JARVIS (E.). **Report of the Entomologist to the Bureau of Sugar Experiment Stations.**—*Queensland Agric. Jl., Brisbane*, iv, no. 6, December 1915, pp. 350–351.

Owing to the prolonged drought at Gordonvale, the larvae of *Lepidiota albohirta* began to pupate in the middle of August, that is, three weeks earlier than in the previous year. During October pupae in volcanic land were found at a depth of from 12 to 15 inches below the surface. The majority were lying in earth that was nearly dry. Further tests made a month later on the same piece of land showed that the soil had become slightly drier and that 20 per cent. of the pupae had been killed. The remainder had transformed into adults which were resting in the pupal chambers until the ground should be sufficiently softened by rain for them to escape.

FROGGATT (W. W.). **The Buff-coloured Tomato Weevil (*Desiantha nociva*.)**—*Agric. Gaz. of New South Wales, Sydney*. xxvi, no. 12, December 1915, pp. 1065–1066.

Desiantha nociva has a wide range over the eastern and southern coasts of Australia, and in New South Wales has been found damaging young buds of fruit trees and vines in early summer, recently having

become a serious crop pest. The eggs of this species are laid in the soil. The larvae remain in the ground during the daytime, emerging at night to feed upon the bark and foliage of the host plants. The habits of the adult are similar to those of the larva.

D. maculata, which is distributed throughout Australia, is equally destructive to fruit trees and vines, while *D. malevolens* causes injury to orchards in the Swan River district of Western Australia. The best method of control is to trap the insects by means of weeds or grass placed in a shallow depression round the roots of the plant. A ring of stiff oiled paper placed round the stem should prevent the weevils from climbing up the plant.

FROGGATT (W. W.). **A Descriptive Catalogue of the Scale Insects ("Coccidae") of Australia.**—*Agric. Gaz. of New South Wales, Sydney*, xxvi, no. 12, December 1915, pp. 1055-1064, 2 plates.

The following species of COCCIDAE are recorded:—*Cerococcus aurantlicus*, sp. n., on *Bursaria spinosa* (blackthorn); *C. bryoides*, Mask., on *Exocarpus cupressiformis* (native cherry) and *Helichrysum diosmifolium*; *C. punctiferus*, Green, on *Pittosporum eugenioides*; *C. pyriformis*, sp. n., on an undetermined shrub; *Kermes acaciae*, Mask., on *Acacia* sp.; *Rhizococcus bicolor*, sp. n., on *Acacia* sp.; *R. casuarinae*, Mask., on *Casuarina suberosa* and *C. distyla*; *R. grandis*, Mask., on the roots of *Acacia longifolia*; *R. lecanioides*, Green, on *Casuarina distyla*; *R. lidgetti*, Ckll., on *Acacia estrophiolata*; *R. lobulatus*, Green, on *Acacia pendula*; *R. mancus*, Mask., *R. pustulatus*, Mask., and *R. tripartitus*, Full., on *Casuarina* spp.; *R. viridis*, Green, on *Acacia decurrens*; *Gossyparia casuarinae*, Mask., on *Casuarina* sp.; *G. confluens*, Mask., on *Eucalyptus* sp. and *G. syncarpiae*, sp. n., on *Syncarpia laurifolia* (turpentine gum).

HILL (G. F.). **Insect Pests of Plants: Northern Territory of Australia.**—*Dept. External Affairs, Melbourne*, Bull. Northern Territory no. 13, August 1915, 16 pp. [Received 27th January 1916.]

This bulletin gives a list of some of the principal insect pests of trees and crops at present grown in the Northern Territory, with information as to methods for their control and the preparation of insecticides.

Melons, pumpkins, marrows:—The Pyralid, *Glyphodes* (*Phacellura*) *indica*, Saund. (melon moth); the Chrysomelids, *Aulacophora hilaris*, Boisd. (pumpkin beetle), *A. palmerstoni*, Blackb. (pumpkin beetle) and *Epilachna 28-punctata*, F. (28-spotted ladybird); the Pentatomid, *Megymenum insulare*, Westw. (pumpkin bug), and the Trypetid, *Dacus cucurbitae*, Coq. (melon fruit fly). An important natural enemy of *Epilachna* has been discovered, viz.:—the Chalcid, *Mestocharis lividus*, Gir.

Tomato:—The Noctuid, *Chloridea obsoleta*, F. (*Heliothis armigera*, Hb.), (tomato moth).

Cotton:—The Pyrrhocorid, *Dysdercus cingulatus*, F. (red cotton bug), the Pentatomid, *Tectocoris lineola*, F. (yellow cotton bug), the Lygaeid, *Oxycarenus arctatus*, Walk. (little cotton bug), the Noctuid,

Earias huegeli, Rog. (boll worm), and the Tineid, *Pyroderces pyrrhodes*, Meyr. (curved-winged cotton moth). A few Tachinid flies and *Graucalus melanops* (black-faced cuckoo-shrike) exercise some control on *D. cingulatus*. The Proctotrupid, *Telenomus darwiniensis*, Dodd, heavily parasitises the eggs of *T. lineola*. The Chalcid, *Bephratella sarcophaga*, Gir., is recorded here for the first time as a parasite of *E. huegeli*, which is also parasitised by three other unidentified Hymenoptera.

Sisal hemp:—The Coccid, *Hemichionaspis minor*, Mask. (sisal hemp scale); the Coccinellid, *Orcus janthinus*, Muls., commonly found on the foliage of *Pandanus odoratissimus*, preys on *H. minor*, which is also controlled by *Anthemus* sp.

Pawpaw:—The Termite, *Mastotermes darwiniensis*, Froggatt, and the Coccid, *Aspidiotus orientalis*, Newst. (oriental scale). The latter is slightly checked by several species of Coccinellids.

Citrus trees:—The Coccids, *Chrysomphalus aurantii*, Mask. (*Aspidiotus coccineus*, Genn.) (red scale of orange), *C. aonidum*, L. (*Aspidiotus ficus*, Ashm.) (brown scale), *Lepidosaphes beckii* (*Mytilaspis citricola*, Pack.) (purple scale), *Lepidosaphes* (*Mytilaspis*) *pallidus*, Green (pallid scale), *Parlatoria ziziphus*, Lucas (lime scale), and *Icerya* sp. (cottony-cushion scale), and the Acridiid, *Cyrtacanthacris maculicollis*, Walk. (brown locust). An entomogenous fungus (*Microcera*) is probably the most effective check on the spread of *C. aonidum*.

Mango:—The Noctuid, *Bombotelia jocosatrix*, Guer. (mango moth), and the termite, *Mastotermes darwiniensis*, Froggatt.

Coconut palm:—The Acridiid, *Cyrtacanthacris maculicollis*; the termite, *M. darwiniensis*, Froggatt; the Curculionid, *Diocalandra frumenti*, F. (*Calandra stigmaticollis*, Gyll.) (little coconut weevil); the Coccids, *Aspidiotus destructor*, Sign. (transparent coconut scale), and *C. aonidum*.

Stored grain:—*Calandra oryzae*, L. (rice weevil). Two Chalcids have been reared in large numbers from weevil-infested grain, which have been determined by Mr. A. A. Girault as *Spalangiomorpha fasciatipennis*, Gir., and *Neocatolaccus australiensis*, Gir.

This paper also gives formulae for kerosene emulsion, oil of tar emulsion, resin compound and tobacco and soap, with brief instructions for making up these insecticides.

RICHARDS (P. B.). **Methods and Materials for the Control of Insect Pests. Part viii.**—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iv, no. 2, November 1915, pp. 33-42. [Received 23rd January 1916.]

This paper deals with hydrocyanic acid gas, carbon bisulphide, sulphur dioxide, carbon dioxide and nicotine, and their use as fumigants. The properties of these substances and the methods of using them are described. The pests of stored seeds and foodstuffs in Malaya include *Calandra oryzae*, *Sitotroga cerealella*, *Ephestia* spp., *Tribolium* sp., several species of Bruchid beetles and *Lasioderma serricorne* (cheroot beetle).

All insects require a certain amount of moisture in their surroundings and their food to enable them to live. Even grain-feeding insects cannot live in thoroughly dried grain. Sun-drying may often be made use of to reduce the moisture present in the attacked food. This is far the best method for peasants and others who have comparatively small stocks to handle.

Correspondence.—*Planters' Chronicle, Bangalore*, xi, no. 1, 1st January 1916, pp. 8-9.

According to Mr. H. L. Andrewes, leaf-spot disease of coffee in British East Africa can be prevented by spraying with a solution made up according to the formula: 40 lb. copper sulphate in 40 gals. water; for use, 4 gals. of stock solution are made up to 40 gals., the acidity being neutralised by the addition of about 14 oz. of calcium carbide, either in the form of lumps or powder. This spray is applied at the end of the rains, and its adhesive power is said to be remarkable.

SMITH (H. S.). **Report of the State Insectary.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 12, December 1915. pp. 542-543.

During the period in which the author was connected with the State Insectary, attention was mainly devoted to a study of two imported pests, namely, black scale [*Saissetia oleae*] and mealy bug [*Pseudococcus citri*]. Several insect enemies of these pests were introduced, including:—*Coccophagus orientalis*, How., a parasite of the partly-grown black scale, from South Africa; the Coccinellids, *Chilocorus bipustulatus*, L., and *Exochomus 4-pustulatus*, L., from Italy, predaceous on black, citricola, purple and other scales; *Paraleptomastix abnormis*, Gir., a Sicilian parasite of the mealy bug; *Scymnus bipunctatus*, Kug., a Coccinellid enemy of mealy bugs, from the Philippines; *Apanteles glomeratus*, L., a Hymenopterous parasite of *Pieris rapae* (cabbage worm); the Chalcid, *Zalophothrix mirum*, Ashm., a parasite of the black scale, from the British West Indies; and *Leucopis* sp., predaceous on mealy bugs. Coccinellids have been distributed every year to melon growers and others for the destruction of Aphids.

FRIZER (J. A.). **Home Manufacture of Lime-Sulphur Concentrate.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, iv, no. 12, December 1915, pp. 547-557, 5 figs.

A plant for the manufacture of lime-sulphur solution is described and illustrated. The average cost of a plant having a capacity of 25 barrels a day is about £37. The quality and cost of materials are important. The sulphur can be used in the form of flowers of sulphur or as a fine powder, the latter costing about one-third less than the former. The lime should be the best obtainable (90 to 100 per cent. of calcium oxide); partially slaked lime should be discarded. The most satisfactory formula is: 50 lb. unslaked lime, 100 lb. sulphur, and 50 gals. water. This should give a solution testing from 29° to 30° Bé.

In beginning operations, 40 lb. lime and 80 lb. sulphur are weighed out. The sulphur is mixed with water to give a thick paste, while the lime is added to 15 gals. water in the cooking barrels. When partially slaked, the sulphur paste is added, the steam turned on, and the solution made up to 40 gals. The time required for boiling is about 40 minutes. When finished, the solution should have a deep reddish colour and be free from undissolved sulphur. After straining, the solution can be stored and kept till required for use if air is excluded by a layer of oil poured on the surface. If good materials are used and if the solution is properly cooked, there should be only a small percentage of sediment. The average cost of the liquid is about 3½*d.* a gallon.

SMITH (H, S.). **A Note on the Western Twig Borer.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 12, December 1915, pp. 572–573, 1 fig.

Polycaon confertus, Lec. (western twig borer) is found more or less abundantly every spring and summer upon various fruit trees, vines, etc., boring into and damaging the new wood. Dead trees of *Arbutus menziesii* (madrona tree) become completely perforated by the larval mines, and probably this is the only tree in which this insect usually breeds. In view of this fact, it is remarkable that the larvae can live and transform within apples, and the beetle has been reared from these. Injury to grape, plum and olives has also been recorded. One beetle is capable of disfiguring an entire tree, while two or three individuals may destroy it. The clearing and burning of dead madrona wood should reduce the numbers of this beetle.

Insect Notes.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 12, December 1915. p. 574.

The following insect pests are recorded :—*Heliothrips fasciatus,* Perg., on olives ; *Phloeosinus cristatus,* Lec. (cypress twig borer), on cypress ; *Ips concinnus,* Mann. (lodge-pole engraver beetle), on *Pinus radiata* and *P. muricata* ; *Merodon equestris,* F. (narcissus bulb fly), on narcissus bulbs ; *Dendroctonus valens,* Lec. (red turpentine beetle), attacking the cambium layer at the base of conifers ; *Elaphidion villosum,* F. (oak pruner), on oak, hickory, and fruit trees ; the Dipteron, *Diplosis pini-radiatae,* on Monterey pines ; *Paratrioza cockerelli,* Sulc., a Psyllid attacking *Solanum capsicastrum.*

Beneficial insects recorded include :—*Triphleps tristicolor,* White, and the Staphylinid beetle, *Oligota oviformis,* Casey, feeding on *Tetranychus telarius,* L. (two-spotted mite) ; the Coccinellids, *Olla abdominalis,* Say, and *Cycloneda sanguinea,* L., feeding in the larval and adult stages on *Phorodon humuli,* Schrank (hop aphis).

MASKEW (F.). **Quarantine Division : Report for the Month of October 1915.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* iv, no. 12, December 1915, pp. 575–577.

The insect pests intercepted were the following :—From China : *Cylas formicarius* in sweet potatoes ; Lepidopterous larvae in garlic ; a Coccid on pears ; *Aulacaspis pentagona* on tea plants. From Hawaii :

Chionaspis dilatata on an unknown plant; *Coccus longulus* on betel leaves; *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapple; *Chrysomphalus aonidum* on green coconuts; Coleopterous and Lepidopterous larvae in avocado seeds; *Lepidosaphes beckii* and *Chrysomphalus aonidum* on *Pandanus* seed. From Japan: A Coccid on plum cuttings; larvae of a weevil in chestnut. From Manila: *Diaspis* sp. on plants. From Mexico: Larvae of a weevil in beans; *Lepidosaphes gloveri* on limes; *Pseudococcus* sp. on dry coconuts in husk. From Tahiti: *Morganella maskelli* on oranges; a Coccid on green coconuts; *Pseudococcus* sp. on dry coconuts in husk. From Washington: *Orthezia* sp. on *Taxus* sp.; *Cydia pomonella* in apples. From Central America: *Aspidiotus cyanophylli*, *A. cydoniae*, and *Pseudococcus* sp. on bananas. From Michigan: *Pseudococcus* sp. on boxwood, *Coccus hesperidum* and *Aspidiotus britanicus* on bay trees. From New York: *Aspidiotus perniciosus* on apple. From Texas: *Aleurodes* sp. on jasmine. From Alaska: *Orthezia* sp. on ferns. From Iowa: Crown gall on deciduous stock. From Louisiana: *Aspidiotus* sp. and *Chrysomphalus* sp. on banana. From New Jersey: *Pseudococcus* sp. on ferns.

EHRHORN (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturist, Honolulu,* xii, no. 12, December 1915, pp. 333–336.

During the month of September, the following pests were intercepted:- From Guam: Lepidopterous larvae and Anthribid beetles in seeds; scale-insects on nipa nuts; Nitidulid beetles on mango seeds. From Japan: *Paralipsa modesta* (bean moth) on beans. From Manila: ants on orchids. From San Francisco: weevils in acacia seeds.

Parasites reared and liberated included:—*Tetrastichus giffardii*, *Diachasma fullawayi*, *D. tryoni*, *Dirhinus giffardii* and *Galesus silvestrii*.

HOLLOWAY (T. E.). **The Borer problem: Two years' experiments in not burning cane trash.**—Reprint from *Louisiana Planter and Sugar Manufacturer, New Orleans,* 19th December 1914. [Received 27th January 1916.]

In a preceding paper it was stated that infestation by *Diatraea saccharalis* decreased in sugar-cane fields where the trash was ploughed under in spring instead of being burnt in the previous autumn and winter [see this *Review*, Ser. A, ii, p. 279]. The experiments have been repeated on a more extensive scale and the results have confirmed the former ones. The increased yield per acre of cane has been very carefully estimated in the case of one plantation and worked out at over £4 10*s*.

HOLLOWAY (T. E.). **Fighting the Sugar-Cane Borer with Parasites and Poisons.**—Reprint from *Louisiana Planter and Sugar Manufacturer, New Orleans,* 18th December 1915.

An annual loss of over 1,000 lb. of sugar per acre occurs in the case of a maximum infestation by *Diatraea saccharalis* (small moth borer), representing, at the present high prices, a loss of something over £10.

In previous articles [see above] the author reported the good results obtained during the first two years in which saving the trash and ploughing it under was tried. During those years it was always easy to find the parasites of *D. saccharalis* during the summer, but in 1915 they were very scarce, and when the counts were made to determine the percentage of infestation in the burnt and unburnt fields, it was found that all were about equally infested by the borer. It is believed that this result was caused by the long period of dry weather during the summer, the drought lasting in different places from 60 to 120 days. In Porto Rico, Wolcott has found that infestation by the borer varies inversely with the rainfall, the less the rainfall, the greater the number of infested canes [see this *Review*, Ser. A, iii, p. 760]. One reason for this may be that dry weather is unfavourable to the parasite, *Trichogramma minutum*. During 1915, experiments in importing beneficial insects from the cane-fields of Cuba have been of such a character as to justify further work in that direction; it is very improbable that the same weather would have a similar effect on every beneficial insect. A third means of control is furnished by applications of lead arsenate; by covering the plants with a poison in powdered form, a poisoned leaf surface is presented to the first young borers and the greater number of dead hearts are thus prevented. Two applications of powdered lead arsenate were made on a plot of cane in the spring of 1915, the powder being shaken on to the young plants from a cheese-cloth bag by hand. When the cane was cut in December, the infestation of stalks was only 5 per cent. in the poisoned plot, while that in the control plot was 24 per cent. The former amount of infestation is of little consequence and the cost of this treatment is small. These experiments will be continued on a larger scale.

HOUSER (J. S.). **Recent tests of materials for controlling San José scale.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, i, no. 1, January 1916, pp. 21–27, 2 figs.

Since it was first observed in Ohio twenty-one years ago, the San José scale [*Aspidiotus perniciosus*] has spread throughout that State and in many places fruit trees have been practically exterminated, largely owing to this pest. Up to the present, the Entomological Department of the Station has answered 1,399 letters definitely referring to it. The home-boiled, dilute lime-sulphur wash; the commercial, concentrated lime-sulphur wash (1 part to 7 parts of water); and the soluble oils (usually 1 part to 15 parts of water) are standard remedies which will control the scale if properly applied. The concentrated lime-sulphur has a tendency to leak through the containers and only an exceptionally well-made barrel or keg will prevent this liquid from escaping. The test results obtained with powdered lime-sulphur compounds were promising, and should further trials prove their efficiency, it seems likely that these will supplant the concentrated liquid sprays as scale remedies, provided that they can be sold at a reasonable figure. Most failures to control this scale are traceable to the fact that only about one-fourth or one-third of the necessary amount of spraying material is used. Trees, especially large ones, should be sprayed from three or four sides, using favouring winds.

GIRAULT (A. A.). **Notes on North American Mymaridae and Trichogrammatidae (Hym.).**—*Entom. News, Philadelphia*, xxvii, no. 1, January 1916, pp. 4–8.

The following species are recorded:—*Abbella subflava*, Girault, reared from Jassid eggs and parasitic on the eggs of the chinch bug [*Blissus leucoptera*]; *A. auriscutellum*, sp. n., from the eggs of *Draeculacephala mollipes*; *Oligosita americana*, Ashm., from Jassid eggs; *O. sanguinea* var. *clavipes*, var. n., a secondary parasite of *Asphondylia miki* on lucerne seed; *Lathromeroides neomexicanus*, sp. n., from Jassid eggs; *Trichogramma minutum*, Riley, from the eggs of *Estigmene acraea*, *Eudamus proteus*, *Bactra lanceolata*, etc.; *Xenufens ruskini*, gen. et sp. n., from the eggs of *Eudamus proteus*; *Anagrus armatus nigriventris*, Gir., from Jassid eggs; *Anaphes perdubius*, sp. n.; *A. picinus*, sp. n.; *A. gracilipes*, sp. n.; *Camptoptera pulla*, Gir., from leaves bearing *Aleurodes* sp. and *Heliothrips fasciatus*; *C. saintpierri*, Gir.; *Gonatocerus dolichocerus*, Ashm.; *G. dolichocerus ashmeadi*, n. var.; *Polynema striaticorne*, Gir.; *P. straticorne* var. *boreum*, var. n., taken by sweeping wheat.

GIRAULT (A. A.). **Three New Species of** *Coccophagus*, **Family Encyrtidae (Hym.).**—*Entom. News, Philadelphia*, xxvii, no. 1, January 1916, pp. 33–35.

Coccophagus magniclavus, reared from *Aleurochiton* sp., and *C. mexicans* and *C. coxalis*, from a fig *Lecanium*, are described as new.

WOODWORTH (C. W.). **School of fumigation held at Pomona California, August 9–13, 1915.** Los Angelos, 1915, 184 pp., 39 figs. [Received 28th January 1916.]

This is a report of a series of lectures and demonstrations given to citrus growers and deals with the process of cyanide fumigation in all its details. There is a very full index and the report forms a handy book of reference on the subject.

FUNKHOUSER (W. D.). **Life-History of** *Vanduzea arquata*, **Say (Membracidae).**—*Psyche, Boston, Mass.*, xxii, no. 6, December 1915, pp. 183–198, 1 plate.

The particulars of the life-history of *Vanduzea arquata*, Say, were compiled from field notes made during the past five years. This Membracid, together with another, less abundant species, *Thelia bimaculata*, F., is common on *Robinia pseudacacia*, L. (locust tree) in central New York State. The ants which attend *V. arquata* locally are *Formica obscuriventris*, Mayr, *F. exsectoides*, Forel, *Camponotus pennsylvanicus*, de G., *Cremastogaster lineolata*, Say, and *Prenolepis imparis*, Say. In spite of the immense numbers of the insects, the trees do not appear to suffer any injury, so that the economic importance of this species is doubtful.

NELSON (J. A.). U.S. Bur. Entom. **The Embryology of the Honey Bee.**—*Princeton University Press, Princeton*, and *Oxford University Press, London*, 1915, 282 pp., 6 plates, 95 text-figs. Price $2.00.

A minute and detailed account of the embryology of an insect, even of one so useful as the honey-bee, may possibly be regarded as an academic study of value only to those interested in questions of cell development and embryology in general. A work of this kind, however, cannot fail to be of very great utility to the investigator of the diseases of bees in the embryonic stage. This book claims to be the most complete treatise on the subject yet published, and the author has apparently spared no pains to make it exhaustive. As he says in his preface, a knowledge of bee behaviour is important to the beekeeper, and the anatomy of the bee is of consequence in this connection. As the total time normally required for the development of the egg is only 76 hours, the changes of structure take place rapidly, and the author has shown much skill and patience in differentiating these, while the numerous text-figures enable them to be followed readily. A table in which the whole process of development is summarised and divided into 15 periods, is of great value. A bibliography of 157 works on insect embryology is appended.

CECCONI (G.). **Manuale di Entomologia Forestale.** [Manual of Forest Entomology.]—*Florence*, 1914–15, Fasc. 1–3, 192 pp., 235 figs.

The three parts so far issued of this book deal with the Italian species of Orthoptera, Dermaptera, Lepidoptera and Rhynchota, which are injurious to forests in Italy. It is hoped to complete this work by the end of the present year, but the author, who is one of the staff of the Forestry School at Florence, has met with difficulty in carrying out his original plan, which was, that all the illustrations should be original.

A brief description of the characters which distinguish each order is given, as well of those families and species which directly or indirectly can be regarded as forest pests. The illustrations are very numerous, the stages of each insect and the nature of the damage done being figured from carefully selected photographs. Under each insect is given its synonymy and popular Italian name, as well as a description of the various stages, with some account of its bionomics, the trees and plants attacked, the damage done and the best methods of control. For a large number of insects a table is given, divided into twelve columns, one for each month in the year, from which the distribution in time of any given insect in Italy may be seen at a glance. This book, which is the first manual of Italian forest entomology yet published, should be of very great value to those interested in the subject, and it is to be hoped that the author will be able to complete the work upon the same lines.

HEWITT (C. G.). **Report from the Division of Entomology for the year ending March 31, 1914.**—*Dominion of Canada, Dept. Agric., Dominion Experimental Farms, Ottawa*, pp. 851–876. [Received 16th February 1916.]

In the infested districts in eastern Canada efforts have been made to keep the brown-tail moth [*Euproctis chrysorrhoea*] in check by the collection of winter webs and by the liberation of natural enemies.

The latter included the parasites, *Apanteles lacteicolor, Compsilura concinnata* and *Meteorus versicolor,* and the predaceous beetle, *Calosoma sycophanta.* The following parasites of *Hyphantria cunea* (fall webworm) were obtained:—*Apanteles, Meteorus, Limnerium validum, L. pilosulum,* the Tachinid, *Varichoeta aldrichi,* Towns., and the Ichneumon, *Exochilum mundum,* Say.

Insects attacking cereals and field crops included *Porosagrotis orthogonia,* Morr., on wheat and oats in Alberta; *Euxoa ochrogaster* (red-backed cutworm), on cabbage, etc., in Manitoba, Ontario and Quebec; *Agrotis ypsilon* (greasy cutworm), on potatoes in New Brunswick; *Cirphis (Leucania) unipuncta* (army worm) on oats and *Setaria viridis* (green foxtail grass) in Manitoba; *Melanoplus atlantis* and *Camnula pellucida* in Ontario, Quebec and southern Manitoba; *Lachnosterna* spp. (white grubs); *Cryptohypnus abbreviatus,* Say, on maize at Ottawa; *Mayetiola destructor,* Say (hessian fly) in Manitoba; *Oscinis carbonaria,* Lw. (lesser wheat-stem maggot) in Manitoba; *Bruchus pisorum,* L. (pea weevil) in Ontario; *Bruchophagus funebris,* Howard (clover seed Chalcid) on seeds of *Trifolium pratense* L. (red clover); *Psila rosae,* F. (carrot rust fly) on carrots and parsnips in New Brunswick and Prince Edward Island; *Anaphothrips obscurus,* Mull (*striatus* Osb.) on oats in Alberta; and *Contarinia (Diplosis) tritici* (wheat midge).

The most important insects attacking fruit crops were *Eucosma (Spilonota) ocellana* and *Olethreutes consanguinana* (bud-moths), and fruit-worms of the genera *Xylina* on apple in Nova Scotia; *Conotrachelus nenuphar* (plum curculio) and *Anthonomus quadrigibbus* (apple curculio) in Quebec; *Rhagoletis pomonella* (apple maggot) and the Aphids, *Aphis pomi, A. sorbi, Myzus persicae* and *Aphis (Hyadaphis) avenae,* on apple in Ontario.

A preliminary survey was made of the injury caused by bark-beetles in British Columbia. The following species were found to be involved:—*Dendroctonus brevicornis* (western pine bark-beetle) *D. monticolae* (western white pine park-beetle), *D. pseudotsugae* (Douglas fir bark-beetle) and *D. obesus* (Sitka spruce bark-beetle). In Quebec, New Brunswick and the Fraser Valley large areas of poplar, birch, maple, etc., were defoliated by *Malacosoma disstria* (forest tent caterpillar). *Lygaeonematus (Nematus) erichsoni* (larch sawfly) was injurious in Manitoba and northern Saskatchewan. Cocoons of this insect imported from Great Britain showed about 68 per cent of parasitism by the Ichneumons, *Mesoleius tenthredinis, Hypamblys albopictus, Microcryptus labralis* and certain Tachinids. The following insects injuring forest trees were also recorded:—*Tortrix (Harmologa) fumiferana* (spruce bud-worm) in Ontario and Quebec; *Ips balsameus* (eastern fir bark-beetle) in Ontario, Quebec and New Brunswick; *Gossyparia spuria* (elm bark-louse) in Quebec; *Cyllene robiniae* (locust borer) in Ontario; *Elaphidion villosum* (oak-twig pruner) in southern Quebec; and *Agrilus anxius* (bronze birch-borer) in eastern Ontario.

The following pests occurred on garden and greenhouse plants:—*Oniscus asellus, Armadillidum vulgare* and *A. quadrifrons,* on *Begonia, Coleus,* etc.; *Rhizoglyphus hyacinthi* (bulb mite); *Isosoma orchidearum* on orchids; *Napomyza (Phytomyza) chrysanthemi,* on chrysanthemums; *Lycophotia margaritosa (Peridroma saucia)* on carnations; and *Aphis maidi-radicis* on asters.

HEWITT (C. G.). **Report of the Dominion Entomologist for the year ending March 31, 1915.**—*Dominion of Canada, Dept. Agric. Ottawa*, 1915, 40 pp., 4 figs., 2 plates, 1 map. [Received 16th February 1916.]

Field work against the brown-tail moth [*Euproctis chrysorrhoea*] was continued during the year. The infestation in New Brunswick and Nova Scotia was very severe during 1913-14, owing to the carriage by the wind of female moths from infested districts in New England. Observations made during the winter showed that a temperature of 30·5° F. was not fatal to all the young larvae in the webs. The favourite food-plants were apple, choke cherry, thorn, amelanchier, and plum; other hosts on which webs were found for the first time were birch, rose, hornbeam, dogwood, hazel, and raspberry. Nearly 88 per cent. of the total number of webs collected were obtained from apple. Feeding experiments carried out in the summer of 1914 showed that first-stage caterpillars would feed and mature on grey birch; this fact is significant, since the birch is abundant in New Brunswick. At Dalhousie, the greatest emergence of larvae in spring took place from webs which had been covered with snow during the winter. In Nova Scotia, the winter dropping of the webs was found to be a serious factor, since it ensured the continuation of the pest.

The collection, breeding, and liberation of the natural enemies of the gipsy and brown-tail moths was continued. These included the parasites, *Apanteles lacteicolor* and *Compsilura concinnata*, and the predaceous Carabid beetle, *Calosoma sycophanta*.

The natural control of three native insect pests was studied, viz:—*Malacosoma disstria* (forest tent caterpillar) *Hyphantria cunea* (fall webworm), and *Tortrix* (*Harmologa*) *fumiferana* (spruce budworm). The study of the life-histories of some of the parasites was completed, but the subject still requires further investigation.

Insects affecting cereals and other field crops were:—*Cirphis* (*Leucania*) *unipuncta*, Haw., attacking oats, barley, etc., throughout eastern Canada; *Melanoplus atlantis* (lesser migratory locust) and *M. femur-rubrum* (red-legged locust) in Ontario, Quebec, and British Columbia; *Euxoa ochrogaster* (red-backed cutworm), *E. messoria* (dark-sided cutworm) and *Lycophotia margaritosa* (*Peridroma saucia*) (variegated cutworm) injuring vegetable crops in Ontario, Quebec, Manitoba, Alberta, etc.; *Lachnosterna* spp. (white grubs), destructive in pasture land and in wheat crops in Ontario and Manitoba respectively; *Cephus occidentalis* (western wheat-stem saw-fly) on wheat and rye in Manitoba; *Chortophila* (*Phorbia*) *brassicae* (cabbage maggot) on cabbage, cauliflower, radish and turnip in all parts of Canada; *Hylemyia antiqua* (*P. ceparum*) and *Pegomyia fusciceps* (onion and seed-corn maggots); *Phlyctaenodes* (*Loxostege*) *sticticalis* (sugar beet webworm), injuring onions and carrots in Saskatchewan, and lucerne, turnips, rape, cabbage, etc., in Manitoba; *Entomoscelis adonidis* (red turnip beetle), on radishes and ten-week stocks in Yukon Territory, and on turnips, spinach and radishes in Alberta; *Papilio polyxenes* (celery caterpillar), on celery and parsley in Ottawa; *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt. (pea aphis), on peas in Ontario and Nova Scotia; *Phytometra californica* (alfalfa looper), on lucerne in British Columbia, and on turnip, lettuce, onion and apple in Ottawa;

Contarinia (*Diplosis*) *tritici* (wheat midge), a pest of grain crops in the Lower Fraser Valley.

With regard to insects attacking fruit crops, the life-histories of the following were worked out:—*Eucosma* (*Spilonota*) *ocellana* (eye-spotted bud-moth), *Olethreutes consanguinana* (larger bud-moth), *Xylina* (*Calocampa*) *nupera*, Lint., *X.* (*C.*) *cineritia*, Grote, *X.* (*C.*) *curvimacula*, Morr., *Graptolitha* (*Xylina*) *lacticinerea*, Grote, and *G.* (*X.*) *bethunei* (fruit-worms of apple). Incomplete notes were obtained on *G.* (*Xylina*) *georgii*, *Conistra* (*Scopelosoma*) *tristigmata*, Grote, and *Ceramica* (*Mamestra*) *picta*, Harr., which were found to be injuring apples. The period in the life-cycle in which these Noctuids were most susceptible to attack was the young larval stage, when the insect feeds on the young leaves and blossoms. The older larvae damaged the fruit, about 20 per cent. of the latter showing injury in unsprayed orchards. In July 1913 the larvae of *G. bethunei* were found destroying the pupae of *Malacosoma disstria*, and constituted an appreciable factor in the natural control of this pest. The codling moth [*Cydia pomonella*] in Nova Scotia appeared to be single-brooded, the life-cycle extending over a long period. *Xyleborus pyri*, Peck, (shot-hole borer) was present in one district in Nova Scotia; the larvae were readily destroyed by the injection into the host tree of carbon bisulphide. In migration experiments with Aphids, it was found that *A. sorbi* migrates, during the latter half of June, from the apple to the plantain. The return to the apple occurs in early autumn. Investigations were also carried out on *Rhagoletis pomonella* (apple maggot), *Tetranychus pilosus* (plum mite), *Haltica chalybea* (grape flea-beetle), *Monophadnus rubi* (raspberry sawfly), *Psylla pyricola* (pear psylla), *Crioceris asparagi* and *C. duodecimpunctata* (asparagus beetles), *Conotrachelus nenuphar* (plum curculio), *Empoasca mali* (apple leaf-hopper), and *Tischeria malifoliella* (apple leaf-miner). Insects affecting apples in Quebec were *Anthonomus quadrigibbus* (apple curculio), *Cacoecia* (*Archips*) *argyrospila* (fruit tree leaf-roller) and *C. nenuphar*.

In British Columbia the fruit insects investigated were:—*Enarmonia prunivora* (lesser apple worm), *Eriosoma lanigerum* (woolly aphis), *Lygus pratensis* (tarnished plant bug), *Formica rufa* and *Anarsia lineatella* (peach twig borer).

Among the insects attacking forest and shade trees, *Lygaeonematus* (*Nematus*) *erichsoni* (larch sawfly) appeared to be spreading westward and killed much timber in eastern Ontario and Manitoba. *Tortrix fumiferana* (spruce bud-worm) was present in the forests of New Brunswick. Injury by *Malacosoma disstria* and *M. americana* in Ontario and Quebec was considerably lessened by natural controlling factors, chiefly parasitic fungi and bacteria. Extensive outbreaks of the same insects occurred in British Columbia. Cerambycid and Buprestid borers and ambrosia beetles caused injury to logs and fire-killed timber. Bark-beetle injury was extensive in British Columbia, where white pine was attacked. Spruce in the same province was injured by *Chermes cooleyi* (spruce gall Aphid), *Aphis abietina*, and *Dendroctonus obesus* (Sitka spruce bark-beetle).

The most important insects affecting garden and greenhouse plants were *Lycophotia margaritosa* (variegated cutworm), *Lygus pratensis* (tarnished plant bug), and *Neocerata* (*Dasyneura*) *rhodophaga*, Coq. (rose midge).

ADAMS (C. C.). **An Ecological Study of Prairie and Forest Invertebrates.**—*Bull. Illinois State Lab. Nat. Hist., Urbana*, xi, Article 2, September 1915, 280 pp., 63 plates. [Received 2nd February 1916.]

This is an elaborate list of the invertebrate fauna of Illinois, considered in relation to its habitat. A bibliography of 331 works, an index and 63 plates are features of the volume. Many of the insects dealt with are figured.

MALLOCH (J. R.). **Some Additional Records of Chironomidae for Illinois and Notes on other Illinois Diptera.**—*Bull. Illinois State Lab. Nat. Hist., Urbana*, xi, Article 4, December 1915, pp. 305-363, 6 plates.

Among the predaceous and parasitic flies occurring in Illinois are the Asilid, *Promachus vertebratus*, Say, the larva of which is predaceous upon larvae of *Lachnosterna*; the parasitic Bombyliids, *Spogostylum anale*, Say, and *Exoprosopa fasciata*, Macq., taken on two species of *Monarda*; *Exoprosopa fascipennis*, Say, which is a hyperparasite of the species of *Tiphia*, which again are parasitic upon *Lachnosterna*; and *Sparnopolius fulvus*, Wied., parasitic upon larvae of *Lachnosterna*.

JARVIS (E.). **The Sugar-cane Beetle.**—*Queensland Agric. Jl., Brisbane*, v, no. 1, January 1916, p. 42.

The heavy rainfall on the 8th November was followed by the emergence, in the Babinda area, of enormous numbers of cane beetles. Three species were observed, namely, *Lepidiota caudata*, *L. albohirta*, and *Anoplognathus* sp. The last-named insect cannot at present be included in the list of SCARABAEIDAE attacking sugar-cane, and is not likely to become troublesome in the future. In spite of the abnormal dryness, beetles which transformed about the middle of September were still alive six weeks later, and were found in their pupal chambers at a depth of from 9 to 12 inches below the surface.

Mississippi Nursery and Orchard Inspection Law.—*Mississippi Agric. Mechan. Coll.*, xii, Bull. no. 4, October 1915, pp. 10–15. [Received 15th February 1916.]

The text of this law, enacted in 1908, and of the rules and regulations attaching to it, are given. These rules and regulations are promulgated by the Entomologist of the Mississippi Experiment Station.

GIBBS (A. E.). ***Rhyssa persuasoria*, the Ichneumon of the Giant Saw-fly, *Sirex gigas*, in Hertfordshire.**—*Trans. Hertfordshire Nat. Hist. Soc., London*, xvi, no. 2, January 1916, pp. 39–40, 1 plate.

Specimens of *Rhyssa persuasoria* were taken at Berkhamsted in July last. The larvae of this species are parasitic on *Sirex gigas*, which is a common borer of fir trees in Britain.

(C253) Wt.P1/106. 1,500. 4.16. B.& F.Ltd. Gp.11/3.

Jepson (F. P.). A Tour of the Coconut Districts of Fiji.—*Dept. Agric., Fiji, Suva.* Pamphlet no. 16, 1915, 4 pp. [Received from the Colonial Office 16th February 1916.]

This is a report of the visit of the Government Entomologist to the chief coconut districts of Fiji between January and April 1915. The spathe-boring moth was found to be common throughout the districts and especially troublesome at Vuna, Nagasau and Vunavessa. The spathes enclosing the inflorescence are penetrated by the larvae of this species. The larvae feed on the flowers and when mature pupate a short distance below the surface of the soil. The adults emerge in from 22 to 25 days and egg-laying begins soon after emergence. *Promecotheca reichei* (coconut leaf-miner) was observed in some plantations, but on account of the high degree of parasitism, probably cannot be regarded as a serious pest. Stick insects [*Graeffea cocophaga*, Newp.] were abundant, extensive damage being caused in some cases. Since the eggs are dropped on to the ground by the female, it is advisable that weeds and grass for a distance of about 12 feet round the trunks of trees should be cut and burned. Magpies introduced into Taviuni some time ago are thought to keep the pest in check in the south part of the island. Bud-rot was found in a few localities in Taviuni, and it is recommended that infected trees should be destroyed. From observations made on the island of Laucala, the author is of the opinion that the exceptionally heavy yield of fruit was correlated with the swarms of bees present. It is considered that the introduction of bees into other plantations is worth a trial.

The only insect pest noticed on bananas was a scale, *Aspidiotus* sp. The leaves of young tea plants at Wainunu were attacked by a small leaf-rolling caterpillar. Cacao was practically free from insect enemies, except at Wainunu, where the leaves of the plants were occasionally attacked by *Adoretus umbrosus* var. *tenuimaculatus* (Japanese rose beetle).

South (F. W.). Summary of Locust Work for the Third Quarter July to September 1915.—*Agric. Bull. Fed. Malay States, Kuala Lumpur*, iv, no. 3, December 1915, pp. 68–72.

The situation as regards locusts has remained practically unchanged. There is no prospect of locust work in Selangor ever assuming large proportions again, and such destruction work as may be necessary will be simple to carry out and involve little expense; only one swarm was left in the State at the end of the quarter. In Johore and the Negri Sembilan on the other hand, destruction work continued throughout the breeding season from the beginning of July to the end of the first week in September. In Johore 320 swarms in all were destroyed, while the total number destroyed in the Negri Sembilan was 1894, of which more than half were in the Tampin district. On the whole, locust destruction work must be considered to be proceeding slowly and satisfactorily in the Federated Malay States and Johore.

ANSTEAD (R. D.). **Report on a Tour in Central Travancore.**—*Planters' Chronicle, Bangalore,* xi, no. 2, 8th January 1916, pp. 12-14.

Central Travancore is, as a whole, remarkably free from diseases when compared with other tea districts. The worst pest is *Helopeltis* which appears to be slowly spreading. Other known food-plants of this pest are cinchona and tea, and probably others exist. The former should be abolished from among the tea plants and the latter kept away from the boundaries as far as possible.

Report on the Agricultural Department, St. Vincent, 1914-15.—*Barbados,* 1915, 23 pp.

Except in the case of cacao and arrowroot, crops were not seriously attacked by insect pests during the year. The damage to cacao by *Heliothrips rubrocinctus* increased in extent; spraying with kerosene emulsion and other washes was carried out. The numbers of *Aleurodicus cocois* (coconut white-fly) in the Leeward District were much less than in the previous year, probably on account of insect and fungus parasites. *Aspidiotus destructor* occurred on coconuts in some localities; in the Carib country the pest appeared to be kept in check by a parasite or predator, or both. Arrowroot in the leeward district was somewhat severely attacked by the larva of the Hesperid, *Calpodes ethlius.*

GREEN (E. E.). **On two new British Coccidae, with notes on some other British species.**—*Entomologist's Mthly. Mag., London,* lii, nos. 13 and 14, January and February 1916, pp. 23-31, 4 figs.

Parafairmairia gracilis, sp. n., and *Lecanopsis longicornis,* sp. n., were found on grasses in the vicinity of Camberley in July 1915. The following species are also recorded:—*Gossyparia ulmi,* Geoff., found on elm at Farnham, Surrey, and well-known as a pest of greenhouse plants, including palms, *Dracaena, Citrus* and oleander; *Aspidiotus ostreaeformis,* Curt., on poplar at Farnham; *Lepidosaphes* (*Mytilaspis*) *ficus,* Sign., on young twigs of edible fig at Wisley and on Japanese maple; *Parlatoria proteus,* Curt., on *Vanda teras,* at Wisley; *Eulecanium* (*Lecanium*) *ciliatum,* Dougl., occurring in Devonshire, Cheshire, Kent and Surrey; *E.* (*L.*) *persicae,* Geoff., on leaves of *Aralia*; *Eriopeltis festucae,* Fonsc., and *Luzulaspis luzulae,* Duf., at Camberley.

THEOBALD (F. V.). **A New Myrmecophilous Aphid from Africa.**—*Entomologist's Record, London,* xxviii, no. 2, 15th February 1916, pp. 37-38.

A description is given of *Aphis pheidolei,* sp. n., found in the nests of an ant, *Pheidole,* sp., at Mwengwa, Rhodesia. This species probably occurs on some native plant, just as the myrmecophilous *Aphis plantaginis,* Schrank, does in Europe.

Back (E. A.) & Pemberton (C. E.). Effect of Cold-Storage Temperatures upon the Mediterranean Fruit Fly.—*Jl. Agric. Research, Washington, D.C.*, v, no. 15, 10th January 1916, pp. 657-666.

Since the introduction of *Ceratitis capitata*, Wied. (Mediterranean fruit fly) into the Hawaiian Islands and the subsequent quarantine measures against Hawaiian fruits, the fruit-grower in the islands has been compelled to devise methods of using his fruit to advantage at home. There are many host-fruits, such as *Persea gratissima* (avocado), certain varieties of *Mangifera indica* (mango) and *Chrysophyllum cainito* (star-apple), which, while often becoming too badly infested to be of use if left to ripen normally upon the tree, become infested so late in their development that they may be preserved for commercial purposes if they respond favourably to cold storage, and if such cold storage kills whatever stages of the fruit fly may be present in the fruit when picked. Primarily undertaken to aid the local horticulturists, the experimental work reported in this paper has yielded results which may be of great commercial importance in defining the conditions under which cold-storage temperatures will kill the fruit fly in stored fruits, thus rendering them free from danger as transporters of this pest from one country to another or even from one infested district to another. A historical review of the use of cold-storage temperatures in economic entomology is given, together with a description of the methods adopted in the present experiments, the results of which are tabulated and discussed in detail. They show that no eggs or larvae of *C. capitata* survived refrigeration at 40° to 45° F. for seven weeks, at 33° to 40° for three weeks, or at 32° to 33° for two weeks. These facts may lead to a modification of existing quarantines and encourage the refrigeration of fruit subject to fruit fly attack. It seems reasonable to conclude that sooner or later the certification of properly refrigerated fruit will be practicable. A bibliography of seven works is appended to this paper.

Fink (D. E.). Control of Injurious Aphides by Ladybirds in Tidewater, Virginia.—*Virginia Truck Expt. Sta., Norfolk*, Bull. no. 15, 1st April 1915, 16 pp., 4 figs., 2 charts. [Received 10th February 1916.]

The introduction and colonisation of the Coccinellid, *Hippodamia convergens*, Guér., was undertaken in Tidewater, Virginia, primarily to aid in controlling *Myzus persicae*, Sulz. (spinach aphis). *H. convergens* is also a natural enemy of other Aphids, of which the following occur in this region: *Aphis brassicae*, L. (cabbage aphis), *A. rumicis* (bean aphis), *Acyrthosiphon* (*Macrosiphum*) *pisi*, Kalt. (pea aphis) and *M. solanifolii*, Ashm. (potato aphis). This bulletin deals with the use of Coccinellids in this method of control, in which *Megilla maculata* (spotted ladybird) was also employed. There are five generations of the ladybirds in Tidewater, Virginia. During July and August they are partly inactive. *H. convergens* prefers smaller, soft-bodied Aphids, while *M. maculata* is less discriminating. The latter is the first to hibernate, usually about mid-November; *H. convergens* during mild winters may continue to feed as late as Christmas, and may be observed during the winter months. Coccinellids are valuable as checks to sporadic outbreaks of Aphids and no further trouble has been reported where they have been colonised.

SMITH (L. B.). **The Pavement Ant** (*Tetramorium cespitum*, **L.**). *Virginia Truck Expt. Sta., Norfolk*, Bull. no. 16, 15 pp., 6 figs. [Received 10 February 1916.]

During the past two years growers in the Norfolk region have been suffering losses from the attacks of *Tetramorium cespitum*, L. (pavement ant). This pest was introduced into the United States from Europe, probably 150 or 200 years ago, since when it has become widely distributed. In America it has become a household pest in towns, but until quite recently, had not been recorded as attacking vegetable crops. It has been observed to feed on the following vegetables: kohl-rabi, cauliflower, cabbage, egg-plant, Brussels sprouts, pepper, tomato, radish, parsley and lettuce. The damage is done to the roots, crown and lower portion of the stem and on the stem and crown resembles that caused by cutworms. The attacks have been found to be more severe during the spring, autumn and winter. Where the nests are accessible, fumigation with carbon bisulphide has proved the most efficient method of control. If the nest occurs on the surface of the ground, a saucer containing a few ounces of the fumigant should be placed on the ground and covered with several thicknesses of heavy canvas for at least twelve hours. If the nest is underground, swabs of absorbent cotton soaked in the fumigant should be pushed down into the nest and the soil packed firmly over them. Where these methods cannot be employed, poison baits may be used. The following Paris green and bran bait formula has given excellent results: Wheat bran, 25 lb.; Paris green, ½ lb.; molasses, 3 U.S. quarts; oil of cloves or other aromatic oil, one teaspoonful; and enough water to make a soft mash. The following soluble arsenic and syrup bait proved even more efficient: Molasses or fruit syrup, 4 lb.; water, 1 U.S. quart; potassium arsenate, ½ oz.; and one orange ground to pulp. The bran bait is sprinkled around the bases of the plants, while a sponge is saturated with the arsenic and syrup bait and placed, to minimise evaporation, in a small cardboard box through the sides and bottom of which holes about one-half inch in diameter have been punched. The box should be placed near the nest or close to the runs of the ants. The sponge should be saturated again three days later and again a third time if the attack continues. Hot water, at 175° F. or more, is very destructive to ants, but fails to reach all parts of a nest which is not on the surface of the ground. The use of fish-scrap fertiliser greatly lessened the attacks and is therefore of some value as a repellent.

COAD (B. R.). **Studies on the Biology of the Arizona Wild Cotton Weevil.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 344, 18th January 1916, 23 pp., 1 fig., 2 plates.

This paper deals with *Anthonomus grandis thurberiae* (Arizona wild-cotton weevil) in Arizona [see this *Review*, Ser. A, iii, p. 545]. This weevil is not known to occur on any plant other than *Thurberia thespesiodes*, which is found from Arizona southwards along the Sierra Madre as far as Guadalajara in the State of Jalisco, Mexico. There is no information as yet concerning the presence of the weevil on this plant in Mexico. As the activity of the insect in nature largely

depends upon the growing and fruiting period of the plant, close observations of the latter were made. Plants growing at elevations below 3,000 feet were all in full leaf and producing squares by the 1st May; at elevations of from 3,000 to 4,000 feet the plants started to form squares shortly after 1st June and produced two or three crops before the end of the season. About the 1st July plants at about 4,500 feet started to form squares, while those above 5,000 feet did not do so until 30th July or later, and produced only one crop. Though this classification is only approximate, as conditions of moisture, exposure, etc., vary greatly at the same altitude in different localities, it shows the extreme variation in the fruiting period. The last crop of fruit (August and September) is always the largest, and blooming extends over a longer period at this time, in some cases into early October. The appearance of the weevils after hibernation is very scattered during the early spring months. General emergence begins early in July and nearly all have emerged by mid-August, and the weevils are active on the plants from then until the advent of the cold weather. There appear to be only one or two generations, the last remaining and hibernating in the pupal cells in the bolls. The emergence of the weevil shows a very decided relation to the *Thurberia* boll, which in spring reaches a condition such that it is easily opened. At this period it seems usually necessary for the boll to be at least slightly moistened to soften the cell before the weevil can emerge. It seems probable that in the vicinity of Tucson (Arizona) the normal emergence in the mountains during the spring and summer months depends largely upon the frequence of the showers and that the general emergence is produced by the rains of July and August.

As regards the relative attraction of cotton and *Thurberia* for the weevils, a large number of cage tests were made which seemed to indicate that unfed hibernated *Thurberia* weevils display no preference for either plant, while those fed on either plant exclusively for a few days after emergence will at first favour that plant slightly when offered a choice, but will soon feed equally on both. From this it would seem that neither plant has the power to attract the weevils from the other, but later observations made in the field did not altogether support this. The field cotton at the ranch was repeatedly attacked by the weevils, and, while there was considerable injury to the squares and bolls on this cotton, only two bolls were attacked on several plants of *Thurberia* growing so close to the cotton that some branches overlapped it. The fecundity of *A. grandis thurberiae* was greater under Arizona conditions than under the unnatural environment of southern Texas, although the daily rate of oviposition was much the same.

In tests of caged weevils on growing *Thurberia* plants, the conditions very closely approximated to those under which the plants and weevils exist in nature. A very high larval mortality was indicated by the fact that while 154 bolls showed signs of weevil injury, only 30, or 19·4 per cent., contained live adults on 2nd January. Most of the injured bolls from which the weevils had disappeared showed only one or two seeds eaten out by the larvae. This larval mortality may explain why the weevil does not increase out of all proportion to the abundance of its very restricted host plant though the females are so extremely prolific. Tests, made in the same manner upon cotton

plants, showed that even on cotton the strong adherence of the weevil to the habit of cell hibernation persists. Though several hundred infested *Thurberia* bolls were collected in various localities and the adult weevils were reared, not a single parasite emerged, nor was any record of parasitism made during the entire season. Only one case of predaceous insects attacking *A. grandis thurberiae* was noted. On 25th September 1914, in the Santa Rita mountains, at about 3,500 feet some PHYMATIDAE were observed feeding on the adult weevils, which have been determined by Mr. Otto Heidemann as *Phymata erosa* var. *fasciata*, Gray, and *Macrocephalus inequalis*, Champ.

WILLIAMS (C. B.). **Thrips *oryzae*, sp. nov., injurious to Rice in India.** *Bull. Entom. Research, London*, vi, no. 4, February 1916, pp. 353-355, 1 fig.

A description is given from female examples of *Thrips oryzae*, sp. n., of which numerous specimens were obtained on very young rice at Madurantakam, South India, in May 1915. The only other species of thrips hitherto recorded as damaging rice are *Haplothrips* (*Phloeothrips*) *oryzae* and *H. japonica* from Japan.

MARSHALL (G. A. K.). **Some injurious Indian Weevils (Curculionidae) -ii.**—*Bull. Entom. Research, London*, vi, no. 4, February 1916, pp. 365-373, 5 figs.

The following new species of injurious weevils are described:—*Emperorrhinus defoliator*, gen. et sp. n., defoliating various fruit trees and alders in the Punjab, Sikkim and Assam; *Coniatus indicus*, sp. n., attacking *Tamarix indica* in Bengal; *Ceuthorrhynchus portulacae*, sp. n., mining in the leaves of *Portulaca oleracea* (purslane) in Bengal; *Baris portulacae*, sp., n., boring in the stems of *P. oleracea* in Bengal; *Athesapeuta oryzae*, sp. n., a serious pest of rice in Madras; and *Acythopeus citrulli*, sp. n., attacking water melons in Madras.

GREEN (E. E.). **Report on some Coccidae from Zanzibar, collected by Dr. W. M. Aders.**—*Bull. Entom. Research, London*, vi, no. 4, February 1916, pp. 375-376.

The collection includes the following species of Coccids:—*Icerya seychellarum*, Westw., on *Citrus limonii*; *Asterolecanium bambusae*, Bdv., on bamboo; *Pseudococcus citri*, Risso, on immature cotton-bolls; *P. crotonis*, Green; *P. perniciosus*, Newst., on a Cucurbitaceous plant; *P. virgatus*, Ckll., on cotton and *Clitoria*; *Coccus* (*Lecanium*) *hesperidum*, L., on indigenous ferns; *Coccus* (*L.*) *viridis*, Green, on coffee; *Pulvinaria antigoni*, Green, on chilies and *Luffa acutangula*; *Ceroplastes floridensis*, Comst., on avocado pear; *Ceronema ? africana*, Maskell, on a leguminous climber; *Aspidiotus cyanophylli*, Sign., *A. lataniae*, Sign., and *A. destructor*, Sign., on husks of coconut; *A. dictyospermi*, Morgan, on mango; *A. ficus*, Ashm., on roses; *A. trilobitiformis*, Green, on *Citrus decumana* and *Ficus elastica*;

Aulacaspis (*Diaspis*) *pentagona*, Targ., on *Hibiscus sabdarifa* and papaw fruits; *Hemichionaspis minor*, Mask., on husk of coconut; *H.* sp., near *rhododendri*, Green, on sisal hemp; *Ischnaspis longirostris*, Sign., on coffee; and *Lepidosaphes beckii*, Newm. (*citricola*, Pack.), on orange.

Green (E. E.). **On a New Coccid Pest of Cacao from Trinidad.**—*Bull. Entom. Research, London,* vi, no. 4, February 1916, pp. 377-379, **3 figs.**

Philephedra theobromae, sp. n., collected from the pods of *Theobroma cacao* in Trinidad, is described. The scales were attended by the ant, *Azteca chartifex*.

Green (E. E.). **On a Coccid injurious to Pine Trees in the Himalayas.** - *Bull. Entom. Research, London,* vi, no. 4, February 1916, pp. 395-397, 3 figs., 1 plate.

Ripersia resinophila, sp. n., occurring on *Pinus longifolia* and *P. excelsa* in the Himalayas is described. This scale is said to occupy gummy (? resinous) cells on the growing shoots. According to Dr. A. D. Imms, this species is very destructive to young trees up to about 8 feet high. The adult female is coated externally with a thick gummy investment resembling gum arabic. The young Coccids, on hatching, crawl up the twigs and become concealed within the pine needles, upon which they feed. Later they become attached to the growing twigs. A fungus readily germinates on the gummy covering during wet weather. The same observer has found the insect in several localities in Kumaon at elevations of from 4,000 to 5,800 feet, the numbers being greatest on hot sunny hillsides. Badly affected trees grow little in height, only in thickness. This scale is attacked by Coccinellidae and parasitic Hymenoptera, while ants swarm on badly infested trees.

Doane (R. W.) & Ferris (G. F.). **Notes on Samoan Coccidae with Descriptions of three New Species.**—*Bull. Entom. Research, London,* vi, no. 4, February 1916, pp. 399-402, 3 figs.

This collection of Coccidae from Samoa contains the following species:—*Asterolecanium bambusae*, Bdv., on bamboo; *Coccus frontalis*, Green, *C. viridis*, Green, *Lecanium psidii*, Green, *Pulvinaria psidii*, Mask., on unidentified plants; *Ceroplastes rubens*, Mask., on mango; *Saissetia nigra*, Nietn., on an unidentified plant; *S. oleae*, Bern., on orange; *S. hemisphaerica*, Targ., on several hosts; *Eucalymnatus tessellatus*, Sign., on an unidentified plant; *Chionaspis citri*, Comst., on orange; *C. samoana*, sp. n., on a species of palm, concealed beneath the woolly covering of the stems; *Hemichionaspis aspidistrae*, Sign., on palm, banana and orange; *Aspidiotus cydoniae*, Comst., on orange; *A. pangoensis*, sp. n., and *Chrysomphalus rossi*, Mask., on coconut husks; *Odonaspis secreta*, Ckll., on bamboo; *Lepidosaphes beckii*, Newm., *L. gloverii*, Pack., *L. moorsi*, sp. n., and *Parlatoria cinerea*, Doane and Hadden, on orange.

WATERSTON (J.). **Notes on African Chalcidoidea. iv.**—*Bull. Entom. Research, London*, vi, no. 4, February 1916, pp. 413-423, 6 figs.

The following species of Chalcidoidea are described:—*Timioderus refringens*, gen. et sp. n., from Nyasaland; *Spilochalcis andersoni*, sp. n., from British East Africa; *Hockeria munda*, sp. n., and *Ooencyrtus lamborni*, sp. n., from Nyasaland. The last-named was bred from the eggs of a Pierine butterfly, *Belenois severina*, Cram.

Shot-hole Borer of Tea.—*Trop. Agric., Peradeniya*, xlvi, no. 1, January 1916, pp. 41-45.

In a discussion at a meeting of the Committee of Agricultural Experiments, Peradeniya, on the 11th November 1915, Mr. Speyer gave the results of some experiments to illustrate the relation of the attack of the shot-hole borer beetle (*Xyleborus fornicatus*) to the general conditions under which tea is cultivated in Ceylon [see this *Review*, Ser. A, iii, p. 666]. The first two experiments showed that the beetles, either by instinct or the process of trial, attack trees which have previously been the subject of attack, and that a number of trees are never visited by them. The results lead to the belief that the tea bushes gradually attain a state in which they invite attack the longer they run from the last pruning and that some bushes hold out against the beetle longer than others; a considerable number do so for the whole period between two prunings, i.e., two years on good soil, and a smaller number on poor soil. In a third experiment the preponderance of trees left unattacked over those revisited was remarkable and this was merely due to pruning. At the beginning of the experiment the effect of previous pruning on the trees first found attacked had not made itself apparent. These trees began to give the best evidence of their immunity towards the middle of the experiment, when the shoots were putting out an abundance of leaves, and at the end of the experiment, which had lasted 3½ months, 100 per cent. of the pruned trees had become immune, even though the galleries of the beetle had not been removed from them, save in the branches pruned. An examination of the 257 trees of the first experiment, made on 24th October—four months after natural pruning—showed that not a single beetle was present in any of the bushes, and some evidence was forthcoming that the beetles are actually forced to leave their galleries in the lower parts of the bushes after pruning. In those branches which put out no shoots after pruning, this is not the case, and it is therefore highly advisable to remove these branches within four months of pruning. It is stated in conclusion that tea grown under exceptionally poor conditions does not seem to establish immunity to the extent which is noticeable in healthy, well-manured fields.

CRAIGHEAD (F. C.). **Insects in their Relation to the Chestnut Bark Disease.**—*Science, Lancaster, Pa.*, xliii, no. 1100, 28th January 1916, pp. 133-135.

According to recent investigations by Studhalter and Ruggles, the Longicorn beetle, *Leptostylus macula*, is the most important carrier of the spores of chestnut blight. The author criticises this statement

as lacking proof. Under normal conditions, *L. macula* never frequents healthy trees, but, together with other species, feeds on the fruit bodies of the fungus, and on some trees from 50 to 75 per cent. of the cankerous area has been found to be eaten clean of pustules. Of the three other beetles stated to be carriers of spores, all are known to feed on dead wood and therefore are not likely to frequent living trees. Certain important insects, e.g., the beetle, *Leptura nitens*, are not mentioned in the investigations. This insect, which is certainly of importance in carrying spores to healthy trees, becomes less so as the infections grow older, owing to its increasing tendency to breed in and frequent diseased trees to the exclusion of healthy ones. Other insects which come under this category are several species of Aegeriid moths, although in these cases adaptation to a life in cankerous tissue has not developed to so great an extent. In many instances blight has been found in wounds made by cicadas and tree-hoppers. These insects may carry the spores and directly inoculate the wound, but this is improbable, since insects of this kind normally frequent healthy trees. In view of the established facts that the ascospores are carried by the wind and the pycnospores are washed down the trunks by the rain, the rôle played by insects in the transmission of the disease by carrying the spores is probably insignificant. The wounds in the cambium caused by insects, where spores can gain entrance, are far more important. Certain insects which frequent diseased trees and feed on the spores must be regarded as beneficial.

LEONARD (M. D.). **The Immature Stages of two Hemiptera, *Empoasca obtusa*, Walsh (Typhlocybidae) and *Lopidea robiniae*, Uhler (Capsidae).**—*Entom. News, Philadelphia*, xxvii, no. 2, February 1916, pp. 49–54, 2 plates.

The early stages of *Empoasca obtusa* and *Lopidea robiniae* are described in this paper. *E. obtusa* spends the winter in the egg-stage on twigs of *Populus deltoides*, Marsh (common cottonwood) and of *Populus nigra italica*, Du Roi (Lombardy poplar). *L. robiniae* was observed on the leaves of *Robinia pseudacacia*, L. (common locust).

AMUNDSEN (E. O.). **The Mexican Bean Weevil.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 1, January 1916, pp. 33–34, 3 figs.

The Mexican bean known as "Guamuchile" is often found infested by *Bruchus limbatus*. The beans are pulp-covered and are produced in pods four to six inches long. The beetle's eggs are laid upon the pods while the latter are quite small, and the larvae, shortly after hatching, bore into the pods and into the beans. The hole in the growing bean soon closes up with the larvae remaining inside and continuing to feed. Just before entering the pupal stage, the larva eats its way to the outer membrane of the bean, leaving a thin skin through which the adult can easily push its way when emerging. Fumigation with carbon bisulphide is generally recognised as the best treatment for infested beans. It appears to be impossible to prevent oviposition in the pods in the field, but to reduce attack,

the beans should be disinfected with carbon bisulphide, 1 lb. to 1,000 cubic feet of space, and sown in soil in which beans have not been planted the previous year. Unless the insects are destroyed very soon after the crop is gathered, they will entirely destroy the beans.

BRANIGAN (E. J.). **Some Notes on the Catalina Cherry Moth.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 1, January 1916, pp. 35–36.

A moth, determined by Dr. A. L. Quaintance to be *Cydia* (*Mellissopus*) *latiferreana*, Wlsm., has badly infested the fruit of *Prunus integrifolia* (Catalina cherry) at Sierra Madre. Both the early stages and the adults resemble those of *Cydia pomonella*. *C. latiferreana* pupates in the ground just at the surface. The cocoon is made of silk, with an outside coating of pebbles and sand, and the winter is passed in the larval stage within the cocoon. One cocoon contained the small white cocoons of a Microgasterine parasite from which the adults had already emerged. The larva of *C. latiferreana* works both in the pulp of the fruit and within the seed itself, which occupies three-fourths of the inside of the cherry. This pest is said to occur from Maine to California.

VOSLER (E. J.). **Calendar of Insect Pests and Plant Diseases.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 1, January 1916, pp. 37–43, 5 figs.

Particulars of sprays for the control of the peach twig borer (*Anarsia lineatella*) and for *Aphis pomi* and *A. sorbi* are given. These formulae have already been published [see this *Review*, Ser. A, iii, p. 274.]

MASKEW (F.). **Quarantine Division, Report for the Month of November 1915.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 1, January 1916, pp. 44–46.

The pests intercepted in the month of November 1915 were:—From Belgium: *Aleurodes* sp., larvae of Thrips and Lepidopterous larvae and cocoons on azaleas; *Coccus hesperidum*, *Aspidiotus britannicus* and *Pseudococcus citrophilus* on bays; *Aspidiotus hederae* on Kentia palms; *Coccus hesperidum* on Dracaena palms and on *Phoenix robelinia*; *Hemichionaspis aspidistrae* on *Aspidistra lurida*. From Holland: *Lepidosaphes ulmi* on *Buxus*. From Fiji: *Pseudococcus* sp. on coconut palms. From Central America: *Pseudococcus* sp. on bananas and orchids; *Cerataphis lataniae*, *Diaspis boisduvalii*, *Chrysomphalus aonidum* and *Coccus hesperidum* on orchids; *Howardia biclavis* on *Aguataca amis*. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapples; *Coccus longulus* on betel leaves; an unidentified Coccid on green coconuts. From Japan: *Chionaspis citri* on pomelos; Lepidopterous larvae in chestnuts; *Aphis* sp. on pot-plants. From Mexico: *Calandra* sp., *C. oryzae* and *Bruchus* sp. in garbanzos (chick-pea); *Chrysomphalus* sp. on coconuts; *Lepidosaphes beckii* and *L. gloverii* on oranges; *Drosophila* sp. in cucumbers. From Tahiti: *Pseudococcus* sp. on pineapples; weevil larvae in sweet potatoes; *Morganella maskelli* on oranges; *Aphis* sp., *Psylla* sp., *Aspidiotus* sp., and *Pseudococcus* sp. on pot-plants. From Cuba: *Saissetia hemisphaerica* on cycads. From Venezuela: *Chrysomphalus*

dictyospermi and *Diaspis boisduvalii* on orchids. From Pennsylvania: *Cerataphis lataniae* on palms. From Idaho: larvae of *Cydia pomonella* on apples. From New Jersey: *Chrysomphalus aonidum, C. scutiformis, Cerataphis lataniae* and *Pseudococcus* sp. on orchids; *Pseudococcus longispinus* on ferns; *Parlatoria pergandii* on orchids. From New York: *Pseudococcus* sp. on Cape jessamine. From Ohio: *Aspidiotus perniciosus* on apples. From Washington: *Cydia pomonella* on apples. From Iowa: crown gall on nursery stock.

PATCH (Edith M.). **Woolly Aphid of Elm and Juneberry** (*Schizoneura americana*, **in part, of authors**).—*Maine Agric. Expt. Sta., Orono*, Bull. no. 241, August 1915, 8 pp., 2 figs. [Received 15th February 1916.]

This bulletin contains an account of the common Aphid causing leaf-curl of the American elm and records the migration of this pest to the Juneberry (*Amelanchier*). The name *Eriosoma* (*Schizoneura*) *americanum* was, until recently, commonly applied to two distinct species by American entomologists. The first of these is the rosette species of the American elm, which migrates to apple, several varieties of mountain ash (*Pyrus* sp.) and to hawthorn (*Crataegus*), where it was known as *E.* (*S.*) *lanigerum* long before its identity with the Aphid of the elm rosette was suspected. The name *E.* (*S.*) *americanum* seems, therefore, to be left free for the species here dealt with. The earlier members of the family, including the stem-mother, are all wingless, but late in June winged generations occur. These take flight and seek fresh food-plants for the establishment of summer colonies. They fly distances of at least ¾ of a mile if they do not find suitable plants near at hand. They migrate to an entirely different habitat, the Juneberry, which is common in Maine and variously known as shad bush, service berry, etc. When the migrant reaches one of these bushes, it settles upon a leaf and creeps to the underside where it usually remains quiescent for the rest of its life. In a few hours it begins to give birth to young and continues to do so for several days. The young Aphids cling to the underside for a short time without feeding and then migrate to the underground stems of the Juneberry, where they settle in groups. In the autumn a generation of winged females is developed from these, which migrates to the American elm. There each female lays a single egg from which the stem-mother hatches in the spring. Several predaceous insects frequent the elm leaf-curls of this Aphid. In Maine the most common ones are a Capsid, *Camptobrochus nitens*, the flocculent larva of a Coccinellid, and Syrphid larvae. Where *Amelanchier* is planted for park or ornamental purposes within the limits of this Aphid's flight from American elm, it would seem desirable to drench the soil at the base of the shrub with Black Leaf 40 or some other good tobacco decoction. This should be done when the colonies are young and susceptible and likely to be nearer the surface than later in the season. Young elms can be protected by spring sprays of tobacco decoction before the leaves become curled. Where large power sprayers are available, old elms sprayed with drive nozzles could probably be cleaned of most of the infestation. Dormant sprays of lime-sulphur heavily coating the elm bark should be tested as to their efficiency in killing the over-wintering egg.

PATCH (Edith M.). **Pink and Green Aphid of Potato** (*Macrosiphum solanifolii*, **Ashmead**).—*Maine Agric. Expt. Sta., Orono*, Bull. no. 242, October 1915, 20 pp., 3 figs. [Received 15th February 1916.]

Aphids with only one food-plant are comparatively easy to control; those with two present certain difficulties, but when, in addition to two favourite food-plants, a species of Aphid will accept others not botanically related, the problem of control is complicated by a new element for every different food-plant. This is the case with *Macrosiphum solanifolii*, Ashmead. At the time that work with this species was first undertaken at the Maine Station, the only food-plants recorded for it were *Solanum jasminoides* and the potato. The following list is now given: *Zea mays* (maize), *Iris* sp. (cultivated), *Gladiolus* sp., *Fagopyrum esculentum* (buckwheat), *Chenopodium album* (white goose-foot), *Amaranthus retroflexus* (red-root pigweed), *Brassica rapa* (turnip), *Capsella bursa-pastoris* (shepherd's purse), *Pyrus malus* (apple), *Rosa* sp., *Phaseolus vulgaris* (bean), *Pisum sativum* (garden pea), *Physalis* sp. (ground cherry) *Solanum jasminoides* (pepper vine), *Solanum melongena* (egg plant), *Solanum tuberosum* (potato), aster (cultivated), *Cineraria* sp., *Lactuca* sp., and *Sonchus oleraceus*. In the spring, *M. solanifolii* is found on rose bushes, in special abundance near the flower buds. Both wingless and winged individuals migrate to potato plants, the former by flying and the latter by crawling, if near enough. In Maine this usually occurs in the first half of July. On the potato the Aphids increase enormously and often before the end of August cover the tender tips and blossom stalks with their colonies. By mid-September the autumn migration is over and the Aphids have deserted the potato fields. They then prefer roses, but will form colonies upon a variety of plants, some of which are common weeds. The last generation of the year consists of the wingless, egg-laying females and the winged males; these appear in Maine about 20th September and only at this time, all the other generations consisting of viviparous females. The insectary observations of 1907 showed that under indoor conditions the true sexes may be produced and the over-wintering eggs may be deposited on both potato and shepherd's purse; it is likely that this generation can be produced on other accepted food-plants also. No evidence has been found in the field, however, that the true sexes or eggs occur normally upon the potato, for the Aphids leave that food-plant earlier in the season when out of doors. It is not known upon how great a range of food-plants *M. solanifolii* will develop in the spring. In Maine it has never yet been collected during this season upon anything but rose, which would indicate this to be the favourite overwintering host-plant and the one ordinarily chosen for oviposition in the autumn.

As regards the economic importance of this Aphid, an attack of less than two weeks' duration suffices to kill the potato stalk for a distance of 4 to 6 inches from the tip, and the growth of the tubers on plants thus weakened must necessarily be affected. Apart from this, the wounds afford a favourable entrance for bacterial or fungus disease. The honey-dew formed when Aphids are abundant is soon attacked by a dark fungus, which must interfere with the natural function of the leaves. *M. solanifolii* has been recorded from Canada, Florida, Maine and California, and from various intermediate localities. Autumn

ploughing, the burning over of weedy places near the potato fields and the burning of the old potato stalks are measures recommended. Cultivated roses should be sprayed with some good tobacco decoction if found to be infested in the spring, both as a direct measure for the rose bushes and an indirect one for the potato crop to which the Aphids migrate later on. If the infestation on potatoes is excessive, a tobacco spray may be applied. For infestation in the greenhouse either tobacco sprays or fumigation may be resorted to. Black Leaf, Black Leaf 40, or a home-made tobacco decoction, containing 2 lb. of tobacco stems or tobacco dust in 4 U.S. gallons of water, may be used. When other insect pests are also present, a combination spray, such as lime-sulphur and tobacco, may often be applied successfully. A bibliography of twelve works is given.

BRAIN (C. K.). **The Coccidae of South Africa—i.**—*Trans. R. Soc. South Africa, Cape Town*, v, no. 2, 18th November 1915, pp. 65-194. 38 figs., 12 plates. [Received 17th February 1916.]

This is an account of representatives of the subfamilies, PSEUDOCOCCINAE, ORTHEZIINAE, COCCINAE, MONOPHLEBINAE, and MARGARODINAE, collected in Cape Colony, Natal and Rhodesia; many new species are described.

BACK (E. A.) & PEMBERTON (C. E.). **Banana as a Host Fruit of the Mediterranean Fruit Fly.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 17, 24th January 1916, pp. 793-804, 4 plates.

Although it has been proved that bananas may serve as host fruits for *Ceratitis capitata*, Wied. (Mediterranean fruit-fly), certain varieties, such as Chinese and Jamaica bananas, when cut and shipped under commercial conditions, have been found to be immune to attack. They therefore offer no danger as carriers of this pest, if properly inspected according to the rules of the Federal Horticultural Board. The immunity of these varieties was rendered more evident from the fact that adult flies of both sexes were trapped in all banana plantations and surrounding fruits known to be hosts were heavily infested. The copious flow of sap from egg-punctures made by fruit-flies in unripe bananas renders oviposition difficult; if eggs are successfully deposited, neither these nor newly-hatched larvae can survive in the tannin-laden peel of green, though mature, fruit. Observations on the Chinese banana have shown that, even when ripe, the fruit is not attractive as a host to fruit-flies under Hawaiian conditions. On the other hand, the rearing of flies from ripe and yellow fruits of the thin-skinned Popoulu variety under experimental conditions leads to the conclusion that ripe bananas in the field may serve as hosts, and should therefore be guarded against in quarantine work. The authors believe that bunches of any variety of banana now growing in the Hawaiian Islands, when properly inspected for the removal of prematurely ripe, cracked, or partially decayed fruits, offer no danger as carriers of the fruit-fly, provided they are wrapped and shipped in accordance with the Federal regulations.

DAVIS (F. W.). **Eighth Annual Report of the Commissioner of Agriculture.**—*Austin, Texas*, 10th September 1915, 32 pp. [Received 23rd February 1916.]

The most important insect pests met with during the year were:—Grape leaf-hopper (*Typhlocyba comes*), peach-tree borer (*Anarsia lineatella*), species of JASSIDAE (leaf-hoppers) and PSYLLIDAE (jumping plant lice), Aphids, potato-tuber moth (*Phthorimaea operculella*), San José scale (*Aspidiotus perniciosus*), grasshoppers and codling moth (*Cydia pomonella*). The methods of control of these insects are briefly indicated. The efficiency of para-dichloro-benzene as an exterminator of household insects and pests of stored grain is also being investigated.

BARBEY (A.). **Biologie du** *Cerambyx heros*, **Scop.** [Biology of *Cerambyx heros*, Scop.]—*Bull. Soc. Vaudoise Sci. Nat., Lausanne*, l, no. 187, December 1915, pp. 621-635, 8 figs. [Received 19th February 1916.]

The Longicorn beetle, *Cerambyx heros*, Scop., is distributed throughout Europe, although it is more abundant in the middle and south of the continent than in the north, and is absent in northern Russia. In the environs of Geneva, in Savoy and in Giessen, this insect infests old oak-trees which border the main roads. The eggs are deposited in wounds or cracks in the bark of the tree. Almost the whole of the life-cycle, which occupies four years, is passed within the woody tissues of the host. The direction of the larval galleries is influenced by the vitality of the wood, the dimensions of the trunk and the state of desiccation of the lignified tissue. When mature, the larva approaches the exterior and bites a hole in the bark in preparation for the emergence of the adult. Pupation takes place in a special chamber formed at the end of a larval tunnel at a short distance from the exterior. The pupal period apparently lasts for several months and the emergence of the adult occurs in the spring. The injury caused by the larva is rarely fatal to the tree, but has the effect of seriously lowering the value of the timber.

Memoria presentada al Congreso de la Nación por el Ministro de Agricultura Dr. Horacio Calderón—1913. [Report presented to the Congress of the Nation by the Minister of Agriculture Dr. Horacio Calderón for 1913.]—*Buenos Aires*, 1915. 531 pp. [Received 28th February 1916.]

Aulacaspis pentagona, *Lepidosaphes* sp., *Saissetia* sp., *Aspidiotus* sp., *Chrysomphalus* sp., *Pseudococcus* sp., *Chionaspis* sp. and other insect pests occurred on plants imported during the year. About 2,000,000 plants were inspected and 1,089,799 were fumigated in the disinfecting chambers at the harbour.

The control of *Schistocerca paranensis* is dealt with, as well as that of a species of locust locally known as "tucura," which has been known for many years in the extreme south, mostly in uncultivated regions. This species has now spread northwards and has injured lucerne, which

is its favourite food-plant. In one case the damage was estimated at 4 per cent. *Prospaltella berlesei* gave good results in the control of *Aulacaspis pentagona*. The infestation of the cotton fields in the provinces of Misiones and Chaco by *Alabama* (*Aletia*) *argillacea* has increased. Both carbon bisulphide and potassium cyanide gave excellent results against ants.

F. P. **Que seront Mildiou et Eudémis-Cochylis en 1916?** [What will be the prevalence of mildew, *Eudemis* and *Cochylis* in 1916?]—*Rev. Vitic., Paris*, xliv, no. 1123, 6th January 1916, pp. 19–21.

After discussing the probable severity of the attack of mildew on vines during 1916, reference is made to the fact that during the previous year the parasites of *Clysia ambiguella* and *Polychrosis botrana* were rare; consequently, during 1916 very little control is to be expected from these natural enemies and the insect pests will probably prove more important than the fungus disease.

Ravaz (L.). **A propos des futures Invasions des Insectes de la Vigne.** [Concerning future Invasions of Insect Pests of the Vine.]—*Progrès Agric. et Vitic., Montpellier*, xxxiii, no. 7, 13th February 1916, pp. 149–152.

During 1915 renewed outbreaks of *Sparganothis pilleriana*, *Clysia ambiguella* and *Polychrosis botrana* were recorded from the vineyards of Argenteuil, Mâconnais, Beaujolais, Hérault, etc. The periodic invasions of *S. pilleriana* depend upon the numbers of its parasites and upon climatic conditions. Early frosts in spring appear to favour the development of late-emerging larvae, the high temperatures of July and August being harmful to the insect. Investigations recently carried out in several districts have shown that the insect is regularly distributed and that some areas which are usually infested are quite free, while other, usually clean areas are seriously contaminated. During the coming season, therefore, outbreaks are to be expected in new districts. *C. ambiguella* and *P. botrana* usually occur together, although of late years the former species has been the more widely-spread. The winter mortality of these insects has been less than in previous years, and it is thus possible that in 1916 the damage done will be more serious than in 1915.

Osterwalder (A.). **Durch das Blatt- und Stengelälchen,** *Aphelenchus ormerodis*, **Ritz. Bos., und** *Tylenchus dipsaci*, **Kühn, verursachte Krankheiten an Zierpflanzen.** [Diseases of ornamental plants caused by *Aphelenchus ormerodis*, Ritz. Bos, and *Tylenchus dipsaci*, Kühn.]—*Bericht Schweiz. Versuchsanst. Obst-, Wein- u. Gartenbau in Wädenswil f. 1913 u. 1914*, Separate from *Landwirtschaftliches Jahrbuch d. Schweiz, Bern*, 1915, pp. 520–522. [Received 26th February 1916.]

This paper records attacks by Nematodes on various ornamental plants.

Schneider-Orelli (O.). **Weitere Untersuchungen über die Lebensweise u. Bekämpfung des kleinen Frostspanners.** [Further researches on the bionomics and control of *Cheimatobia brumata.*] —*Bericht Schweiz. Versuchsanst. Obst-, Wein- u. Gartenbau in Wädenswil f. 1913 u. 1914*, Separate from *Landwirtschaftliches Jahrbuch d. Schweiz, Bern,* 1915, pp. 522–533. [Received 26th February 1916.]

Judging by captures on adhesive bands, the flight period of *Cheimatobia brumata* in 1914 extended from 20th October to 3rd December. As previously observed, some females do not attempt to pass the bands, but oviposit beneath them. From eggs deposited in this way, a total of 970 caterpillars emerged on three pear trees from 14th April to 6th May 1915. Males have often been observed to begin climbing quite high up on a trunk in their search for females, but experiment showed that direct attraction is not always necessary. When two trees were banded with double rings separated by a 3-foot space, both males and females were taken on the lower ring, but only males on the upper one. Defects, thought to be responsible for the lack of success in banding, include the bad quality of the adhesive, which should be able to hold the strongest female; the formation of bridges over the banding either by the bodies of captured individuals or by leaves; crevices between the paper and the bark which permit the females to creep through; delay in banding, in which case some of the females may have already reached the upper part of the tree; infestation due to caterpillars hatching in spring from eggs laid beneath the banding—this may be prevented by maintaining the banding until May, or by cleansing the trunk below the bands when they are removed at the usual time; occasional pupation of the caterpillars in the upper portions of the tree instead of in the ground. The best adhesives were found to be the yellow American preparations, while the dark-coloured ones were also very serviceable, though not possessing the very marked freedom from fluidity and the lasting effects of the lighter coloured ones. As a result of experiments on the influence of spring frosts on the increase of *C. brumata*, it was proved that even when severe in character they do not exert any marked check. Other temperature experiments showed that this moth is almost insensible in the pupal stage to extremes of either heat or cold.

Бюллетень о вредителяхъ сельскаго хозяйства и мѣрахъ борьбы съ ними. [*Bulletin on the Pests of Agriculture and Methods of Control*], Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 6, June 1915, 33 pp., 11 figs. [Received 8th February 1916.]

The following articles relating to Entomology appear in this number:—

Averin (V. G.). **Состояніе сельско-хозяйственныхъ культуръ въ отношеніи вредителей по даннымъ Энтомологическаго бюро и по сообщеніямъ корреспондентовъ.** [A statement as to the pests of cultivated plants based on the records of the Entomological Bureau and reports of correspondents], pp. 13–18.

The following pests were reported in May in orchards: the weevils, *Anthonomus pomorum*, L., *Rhynchites pauxillus*, Germ., *R. bacchus*, L.,

Byctiscus betulae, L. (*R. betuleti*, F.), *Apion pomonae*, F., which was very numerous on leaves of apples and pears, and *Elytrodon bidentatus*, F., frequently captured on sticky belts; *Lethrus apterus*, Laxm., injuring strawberries and ornamental flowering plants, *Melolontha melolontha*, L., injuring young oaks and chestnuts, *Byturus tomentosus*, F., injuring the flowers of strawberries, the leaves of which were also greatly damaged by *Haltica rubi*, Pk.

The caterpillars of *Eucosma* (*Grapholitha*) *ocellana*, *Olethreutes* (*G.*) *variegana*, *Parornix* (*Ornix*) *petiolella*, Frey, and other related species infested apple, pear, plum and cherry trees; those of *Hyponomeuta variabilis*, Zell., were found on bird cherry. *Cheimatobia brumata*, L., mainly injured oaks, but also attacked elms, maples, elders, bird cherry, wild pear, walnut and limes; *Hibernia defoliaria*, Cl., was present in small numbers in company with it. *Aporia crataegi*, L., was largely parasitised by *Apanteles glomeratus*, L. *Euproctis chrysorrhoea*, L., and *Malacosoma neustria*, L., re-appeared after an interval of some years; caterpillars of *Episema* (*Diloba*) *coeruleocephala*, L., were found occasionally on apple trees and those of *Abraxas grossulariata* on gooseberries; *Psylla mali*, Först., was present, but did little damage. *Vanessa polychloros*, L., and the Aphid, *Chaitophorus ribis*, L., were also reported.

Pests of market-gardens included *Phyllotreta undulata*, Kut., on cabbages; *Psylliodes attenuata*, Koch, on hemp; *Lema 12-punctata*, L., on asparagus; and *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., on beet.

Pests of cereals included *Oscinella* (*Oscinis*) *frit*, L., on barley; *Contarinia tritici*, Kirby; *Chlorops taeniopus*, Mg.; *Limothrips denticornis*, Hal.; *Lema melanopa*, L.; *Pyrausta nubilalis*, Hb. (*Botys silacealis*, Hb.) in stubbles of the previous year's maize; and *Oria* (*Tapinostola*) *musculosa*, Hb., which was checked by the cold weather conditions.

Forests were injured by *Cheimatobia brumata*, *Hibernia defoliaria*, *Stilpnotia salicis*, L., *Melolontha melolontha*, *M. hippocastani*, *Agelastica alni*, L., on alders, and *Rhyacionia* (*Retinia*) *buoliana*, Schiff., on young pines; *Chermes viridis*, L., on firs; *Arge* (*Nematus*) *berberidis*, Kl., on barberry; and *Lophyrus pini*, L.

IVASHTCHENKO (A.). **О поврежденіи смородины гусеницей стеклянницы.** [On injury to currants by caterpillars of *Sesia tipuliformis*, Cl.], pp. 20–21.

In the middle of May red currants were injured by the larvae of *Aegeria* (*Sesia*) *tipuliformis*, Cl., inside the branches, at the ends of which they pupated.

E. Tz. **Электричество въ борьбѣ съ муравьями.** [Electricity for the control of ants.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 6, June 1915, pp. 598–599. [Received 21st February 1916.]

This is a reference to an article by S. A. Kamorsky in a beekeeping journal, recommending the use of electricity for the protection of beehives from ants. A ring of copper, about 2 inches wide, is placed

round each leg of the hive at some distance from the ground and another of zinc of the same width about 4 inches higher. These rings are connected with copper wire, giving rise to a very weak electrical current sufficient to keep away the ants and even to destroy them. They require no attention and remain active for an indefinite period.

SEVASTIANOV (I.). **О клопѣ—вредителѣ помидоровъ.** [On a bug injuring tomatoes.] — **«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 6, June 1915, pp. 620–624. [Received 21st February 1916.]

During 1915, frequent complaints have reached the Entomological Station at Tashkent of the injury by *Dolycoris penicillatus*, Kozv., which is frequently found in company with *Aelia furcata*, Fieb. The former has not been previously reported as a pest, but it injures tomatoes by piercing the skin of the fruit and sucking it, which frequently results in bacterial disease setting in. *D. penicillatus* also injures cereal crops by sucking the young grain in the ears. Only one generation occurs and the imago hibernates. The control of this pest must be directed against the hibernating stage by burning the stubbles on the fields and the wild plants surrounding them. Spraying methods are hardly likely to be effective, but in small market-gardens the insects may be collected by hand; trenches round fields and market-gardens are also useful.

DOBRODEEV (A.). **Гороховые слоники и мѣры борьбы съ ними.** [Pea weevils, *Sitones crinitus*, Ol., and *Sitones lineatus*, L., and methods of controlling them.]—**«Труды Бюро по Энтомологіи Ученаго Комитета Министерства Земледѣлія.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Ministry of Agriculture*], *Petrograd*, 1915, xi, no. 8, 32 pp., 12 figs.

The early stages of *Sitones crinitus* and *S. lineatus* are described and figured. The life-history of the two species is practically the same. The adults appear early in spring, as soon as the snow disappears; in Central Russia usually at the end of April. Their food-plants are peas, beans, lentils, vetches, clover, lucerne, lupins, etc. The chief damage is done during May and decreases in June, when the weevils begin to diminish in numbers. Another generation appears in August, but is not injurious, as the weevils take little food, but during this period the plants suffer from the attacks of the larvae on their roots. The eggs are laid directly on the earth, mostly round the collar of the plant. The egg stage lasts about 14 days.

Various Carabid beetles, especially *Ophonus* (*Harpalus*) *pubescens*, Mull., devour both the weevils and their larvae, while the Staphilinid, *Philonthus ebeninus*, Grav., is always found among the larvae. Measures such as spraying or reploughing are impracticable, as young seedlings are scorched by the weakest possible solution of Paris green, and reploughing is impossible in June and July, when the larvae are most active. On limited areas and before the weevils can fly, the fields can be protected with some success by boards smeared with a sticky material and sunk a few inches into the ground. Fumigation with smoke from heaps of burning straw proved

very effective, and must be applied at the time when the fields are first attacked. Powdering with basic slag, when the plants first appear, is also effective and should be done after rain or after previously spraying with water.

A key to the identification of various species of *Sitones* is given, including *S. tibialis*, Hbst., *S. crinitus*, Hbst., *S. waterhousei*, Walt., *S. sulcifrons*, Thunb., and *S. lineatus*, L. *S. tibialis* and *S. sulcifrons* injure leguminous plants used for forage, while the others attack those grown for seed.

SHIPELEV (K.). **Борьба съ вредителями малины.** [The control of pests of raspberrries.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, xiii, no. 2, 23rd January, 1916, pp. 51–56.

Raspberries are attacked by *Pentatoma baccarum* and *P. bicolor*, which produce a peculiar taste and smell in the berries, the former being particularly injurious; no really effective remedies against these pests exist, the one usually applied consisting of shaking the insects from the bushes and hand collection, for which purpose a hand-shield covered with tanglefoot may be used with advantage. Against flea-beetles, which are particularly injurious in dry and hot weather, manuring with basic slag and spraying with various insecticides are recommended. *Aphis urticaria* and *Siphonophora rubi*, which are the most common Aphids attacking raspberries, are controlled by spraying with tobacco extract, soap and crude spirit, quassia decoction or emulsion, or with soft soap. *Aegeria* (*Sesia*) *tipuliformis*, the larvae of which live inside the young stems of currants, but which also frequently attack raspberries, may be controlled by cutting away the affected shoots, as well as all the stumps remaining from the previous year, while the moths may be caught on sticky sheets. The larvae of *Aegeria hylaeiformis* occur during the autumn, winter and spring inside the base of the shoots of raspberries and pupate in the roots; the infested shoots should be destroyed. *Aristotelia* (*Gelechia*) *micella*, Schiff., oviposits underneath the bark of the young shoots, causing small swellings on them. Similar swellings are also caused by some species of CYNIPIDAE, such as *Diastrophus rubi*, Kl. The young flower-buds are injured by *Anthonomus rubi*, against which spraying early in spring with barium chloride or Paris green is advised. The same insecticides are also recommended against *Malacosoma neustria*. *Byturus tomentosus*, F., emerges from the earth in the adult stage in May and up to the time of blossoming of raspberries frequents the flowers of cherries, plums, apples, etc. The larvae attack the flowers and afterwards penetrate into and feed on the seeds of the maturing berries. The larval stage lasts about two months, and at the end of July the larvae drop to the ground with the fruit and pupate in the soil, producing adults in the autumn, which remain in the earth over the winter. The adults should be shaken off the bushes and sprayed with carbolic acid or vinegar water (5 pints of crude carbolic acid or strong vinegar in 27 gallons of water, with 1 lb. of soft soap). This spraying may cause the concentration of the adults on trap-bushes of meadowsweet or medlar, where they can be conveniently collected. The control of the larvae consists in the timely removal of the infested fruits.

SCHREINER (J. F.). **Зимняя пяденица и способы ея уничтоженія.** [*Cheimatobia brumata* L. and its control.]—**«Труды Бюро по Энтомологіи Ученаго Комитета Министерства Земледѣлія.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Ministry of Agriculture*], *Petrograd*, 1916, vi, no. 2. Third enlarged and revised edition, 19 pp., 6 figs.

Cheimatobia brumata is found all over European Russia from Abo in Finland to the Black Sea. In Petrograd and the Baltic provinces the adults appear about the end of September and first half of October, in Central Russia at the end of October, and in the Crimea at the end of November; the males appear three or four days before the females. In great cold some of the pupae remain over the winter and produce adults the following spring. The eggs are deposited singly, rarely in masses, on branches of apple, pear, cherry, quince and other fruit trees, also on oak, which is specially preferred, lime, nut, hornbeam, etc. The eggs hibernate and the caterpillars emerge when the buds begin to unfold. This moth has been recorded as a pest in Russia since the forties of last century, when it injured orchards and forests in the Baltic Provinces. The damage done is very serious, and repeated outbreaks in one orchard weaken and exhaust the trees and may cause their death.

The author observed in 1906 in the government of Petrograd a number of Dipterous and Hymenopterous parasites of the imago, which were not identified; the pupae are attacked by the Tachinid, *Lypha dubia*, Fall., and by two Ichneumonids; the caterpillars are parasitised by one Braconid and two species of Proctotrupids, and the eggs by another Proctotrupid, identified by Howard as *Telenomus nitidulus*, Thoms.

The control of this pest is now fairly widely undertaken and consists of placing adhesive belts round the trunks of trees in autumn, so as to catch the crawling females; the best substance for this purpose is tanglefoot, but home-made adhesives, consisting either of 2 parts of resin and 1 part of wood oil, or of 4 parts of resin, 4 parts of silver fir pitch, 3 parts of crude linseed oil and 3 parts of vaseline, may be used with advantage. These home-made preparations lose their adhesive properties after some days and must be renewed, and the latter one must be applied to the tree in a hot state by means of a brush. The females, not being able to pass over the belts, frequently deposit enormous quantities of eggs below them on the trunk or on the belts themselves; these can be destroyed by spraying with copper sulphate (3 lb. of sulphate and ½ lb. of rye meal paste in about 5 gallons of water). Spraying in spring against the caterpillars may be carried out with Paris green (about 2 oz. of green, 4 oz. of freshly slaked lime, and 1 lb. of rye meal paste, in about 12 gallons of water), lime arsenite (1 lb. of white arsenic, 2 lb. of soda and 3 or 4 lb. of quick lime in from 190 to 210 gallons of water), Urania green or lead arsenate. Deep cultivation of the soil, to prevent the emerging adults from reaching the surface, is also advised.

OL. (I. A.). **Долгоносики, вредящіе плодовымъ деревьямъ и мѣры борьбы съ ними.** [Weevils injuring fruit-trees and their control.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, xiii, nos. 3, 4 & 5, 30th January, 6th & 13th February 1916, pp. 85–87, 115–119 & 142–148.

This paper gives an account of the life-history and control of various harmful weevils including:—*Anthonomus pomorum*, L., *Rhynchites pauxillus*, Germ., *R. bacchus*, L., *R. giganteus*, Kr., *R. auratus*, Scop., *R. cupreus*, L., *R. aequatus*, L., *Byctiscus betulae*, L. (*R. betuleti*, F.), *R. coeruleus*, Deg., and *Sciaphobus squalidus*, Gyll. [see also this *Review*, Series A, i, p. 438, ii, p. 337 and iii, p. 533].

SHTCHERBAKOV (Th. S.). **Перспективы изученія клевера съ точки зрѣнія опытно-энтомологической.** [The possible results of studies of clover from an experimental-entomological point of view.] The Shatilov Agricultural Experimental Station of the Department of Agriculture, *Kiev*, 1915, 25 pp.

This is a paper read at the Conference on pests of clover, convened by the Zemstvo of the Government of Tula on the 9th April 1915. The author deals with the subject much on the same lines, although more elaborately, than in his previous paper [see this *Review*, Series A, iii, p. 641] and concludes that the injury done by *Apion* is so small as to be negligible. The decrease in the crop of clover, which frequently leads to the abandonment of its cultivation, is not due to injury by *Apion* spp. nor to the scarcity of natural pollenisers, such as humble bees, but to chemical processes in the soil and biological phenomena in the plant itself, to which further investigation must be directed.

DOBROVLIANSKY (V. V.). **Современное положеніе вопроса о средствахъ для истребленія вредныхъ насѣкомыхъ въ связи съ условіями текущаго момента.** [The present position of the question of means for the control of insects in connection with the conditions of the moment.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, xi, no. 3-4, 11th February 1916, pp. 42–51.

The author reviews the various substances in use for the control of insect pests, which he divides into contact and stomach insecticides, the first being used mostly against sucking and the second against gnawing insects. For many years, Paris green, which is almost exclusively manufactured in Germany, has been used as the chief stomach insecticide, but its many disadvantages have produced attempts to find some substitute for it. Owing to the war, the importation of Paris green into Russia has ceased, and the moment is considered opportune to replace it by other insecticides, which can be manufactured in Russia, such as barium chloride, lead chromate, sodium arsenite and arsenate, lead arsenate or gypsin (this name being derived from the English word gipsy-moth), and lime arsenite and arsenate. Of these, arsenite of lime is regarded as the most suitable for use against orchard pests. At the Kiev station it is prepared as follows:—1 lb. of white arsenic and 2 lb. of soda are boiled

for about half an hour in about 3 gallons of water till the whole of the arsenic is dissolved, and then 4 lb. of quicklime is gradually added and boiled for another half hour, stirring from time to time. The water lost by evaporation is then made up to 3 gallons, and for use, this is further made up to 80 or 100 parts by volume of water. Barium chloride can be effectively used against field pests in dry and hot weather, and sodium arsenite or arsenate in wet weather. As regards contact insecticides, various emulsions, lime-sulphur solutions, etc., only quassia decoction and tobacco extract have deservedly come largely into use. Attempts have recently been made to advocate the use of other home-made vegetable insecticides, but the author is of opinion that these can only, at the best, prove profitable in small orchards and market-gardens, as their poisonous properties are still uncertain.

VASSILIEV (E. M.). **Положеніе вопроса о паразитахъ амбарнаго долгоносика.** [The position of the question of the parasites of *Calandra granaria*, L.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, xi, no. 1-2, 28th January 1916, pp. 20-23.

This paper, read at the Kiev Conference on pests of stored grain [see this *Review*, Ser. A, iv, p. 106], deals with the parasites of *Calandra granaria*. In 1909 in stores in the government of Kiev, numbers of PTEROMALIDAE were observed emerging from bags containing rye and infested with *C. granaria*. The parasites were more numerous on the more heavily infested bags and the author was able to estimate the degree of infestation by the number of parasites present. These Pteromalids were identified by N. V. Kurdjumov as *Lariophagus distinguendus*, Först. Other parasites of this weevil which have been reported include:—*Pteromalus tritici*, Goureau, *P. calandrae*, How., *P. oryzae*, Cam., *Meraporus utibilis*, Tuck., *M. vandinei*, Tuck., *M. requisitus*, Tuck., and *Cerocephala conigera*, Wstw. The last-named is also a parasite of *Hylesinus fraxini*, *Scolytus pygmaeus* and *Sitophilus granarius*.

DEL GUERCIO (G.) & MALENOTTI (E.). **Ricerche ed Esperienze nuove contro la Bianca-Rossa degli Agrumi in Sicilia nel 1914.** [Researches and new Experiments against *Chrysomphalus dictyospermi*, Morg., in Sicily in 1914.]—Separate, dated 10th August 1915, from *Redia*, *Florence*, xi, pp. 1-126, 25 figs., 1 plate. [Received 21st February 1916.]

In view of the losses sustained by citrus cultivators in Sicily owing to the attacks of *Chrysomphalus dictyospermi*, Morg., the Italian Ministry of Agriculture sent the authors to that island in 1914 for the purpose of studying the pest and discovering suitable control measures. A preliminary report of the spraying experiments has been already published [see this *Review*, Ser. A, iii, p. 430].

C. dictyospermi was first discovered in Italy in 1895 by Berlese on *Pandanus graminifolia* in the Botanical Garden at Florence, but the present severe infestations are due to importations from France along the Riviera, whence they have spread to southern Italy. The various stages of this scale are described in detail. The number of males is

twice that of the females, or even more, especially on the fruit. Tables are given to show the influence of the seasons on infestation. The temperature has a great influence on the number of larvae which emerge from the shields at the period of maximum emergence, an abrupt fall diminishing the number and an abrupt rise increasing it. A very high temperature in July, when the temperature rose to 104° F. at 1 p.m., hastened the dessication and the fall of a large number of adults which had been sprayed with a 5 per cent. solution of colloidal polysulphide of calcium. In autumn the varying frequency and quantity of rain explains the different results yielded by colloidal polysulphide sprays. In the months of February, March and nearly the whole of April, no larvae were seen to emerge even on heavily infested plants. This observation was in apparent conflict with the presence of young larvae, but these were all born in the previous November and December. Larvae which attach themselves from mid-November onwards develop so slowly that the first moult has not taken place after a month, whereas only 12–15 days are necessary with June larvae. Oviposition begins from late in April to early in May, but proceeds very slowly and the clusters never contain much more than about 15 eggs and may therefore often pass unnoticed. This species is certainly oviparous, but if the shield of a female be raised, it will be seen that most of the larvae have already hatched. The fact that more larvae than eggs are usually found beneath the shield accounts for the belief that the species is viviparous. Observations on Coccids of genera allied to *Chrysomphalus* show, however, that a species which is usually oviparous may occasionally produce living young, especially towards the end of the oviposition period. Observations on the speed with which the larvae of *C. dictyospermi* spread, show that they do not move far from the centre of infestation; they have a tendency to climb, especially if they happen to be on the trunk and larger branches, and if the lower portion of the foliage is infested, this is largely due to larvae falling from infested parts above; larvae which fall to the ground perish. External causes are therefore responsible for the spread of this pest from plant to plant. Infestation is strongest on the leaves and fruit and also occurs on young shoots and on various parts of the flower, the larger branches and the trunk being immune. The principal causes of the spread of the insect are pruning, gathering the crop, irrigation, rain and wind. Pruning carried out when the scale is very active is more dangerous than in winter. The best plan is to prune in winter, either letting the prunings dry where they fall, or removing them to a distance of several yards from plants still uninfested. In the case of lemons, which are also pruned at seasons other than winter, the prunings must be left where they fall, so that infestation may be restricted to the plants already attacked. Gathering the fruit is usually done in winter, except in the case of lemons, limes and some oranges. The danger is therefore chiefly present in these latter cases. Irrigation of the citrus plantations is less dangerous than appears at first sight, and it is only in cases where a larva is carried by the water and thrown on a trunk around which there is no ring of foam that it is able to ascend the plant; infested leaves may, however, be carried by the water. Gentle rain falling on mobile larvae washes them down to the lower portions of the plant. A heavy rain reduces

the number of larvae by washing them down to the ground, where they perish, but may carry infested leaves to considerable distances. Wind must however be held to be the most important agent in diffusion. Branches isolated by rings of cotton from the infested portion of a plant were found to be infested after a certain time if the wind was blowing. The importance of wind-carriage is evident from the fact that plants sheltered from the wind are the most strongly infested, as a larger number of larvae are left on them. Strong wind and rain together act by carrying the larvae in the rain drops, as has previously been noticed by Del Guercio in the case of *Ceroplastes sinensis*, D. G.

A list of 56 food-plants is given, including the following:—*Acacia longifolia, A. retinoides, Arbutus andrachne, Callistemon* sp., *Citrus aurantium, C. deliciosa, C. limonum, C. sinensis, Cycas revoluta, Eriobotrya japonica, Euonymus europaeus, E. japonicus, Ficus stipulacea, Hedera helix, Kentia* sp., *Melaleuca* sp., *Metrosideros* sp., *Mühlenbeckia platyclados*, various species of palms, *Pandanus graminifolia. Phormium* sp., *Strelitzia reginae* and *Zea mays*. Observations on these plants show that *C. dictyospermi* can develop and attain maturity on them. The Coccid was seen on some other species, but though the larvae became attached on them, they died at a certain stage, probably because the juices were not suitable. This was noticed on the grape vine, peach and apricot, which in Sicily are cultivated promiscuously with citrus plants. *C. dictyospermi* was never observed on them when they were at a considerable distance from the citrus trees. They are therefore not true hosts and may be transported without any risk of spreading infestation. Nor is there any risk in the transport in winter of deciduous plants of which the leaves alone are subject to attack. It was found that the natural mortality among larvae in favourable conditions amounted to 5 per cent. before fixation. In late autumn, however, especially in rainy weather, eggs which had dried up and dead larvae were observed under the mother's shield. After fixation, early in June, larvae 15–20 days old showed a natural mortality of 5–10 per cent. Later on, the adult female mortality was 2 per cent., increasing to 15 per cent. in October and 25 per cent. late in November, at which time the mortality of adult males was 40 per cent. and that of larvae and nymphs 19 per cent. These figures were allowed for in estimating the value of insecticides.

The economic importance of *C. dictyospermi* in Italy varies in different regions; at the present time the extensive citrus groves of Sicily and Calabria are the most menaced. This pest was introduced into Italy without its natural enemies. None have been found either in Liguria or Tuscany, and during 1913 and 1914 the authors noticed very few endophagous or predaceous species in Sicily. According to De Gregorio, *Aphelinus silvestrii*, De Greg., exercises useful control. The predaceous species destroy not more than 10 per cent. of the adult Coccids and the endophagous species are even less efficient, for only one Chalcid nymph was found in about 30,000 Coccids examined. In America, *Aspidiotiphagus citrinus* is a parasite of *C. dictyospermi*, while *Aphelinus chrysomphali* is reported to be useful in the Iberian peninsula. Cultural methods of control include pruning and defoliation. Pruning is valuable because a properly pruned tree offers less shelter to the Coccid against unfavourable climatic factors,

and green pruning directly diminishes the number of the scales. Some growers have thought that complete defoliation is equivalent to suppressing infestation, but this cannot be the case, as infestation is not confined to the foliage.

The report of work done with insecticides occupies over three-fifths of the paper and the experiments are described in detail. The study of the immunising power of insecticides was undertaken on a considerable scale in Sicily, with better success than previously obtained in Liguria by Del Guercio. This attempt to discover whether the plants could be rendered distasteful to the young larvae for a period sufficiently long to make it impossible for the individuals of one whole generation to attach themselves, showed that the addition of a colloidal adhesive so increased the insecticidal power of polysulphide of calcium as to make such an addition indispensable in the control of *C. dictyospermi* on citrus plants. The polysulphide of calcium was prepared as follows: 6 gallons of water were put in a boiler of 69 gallons capacity and heated to 113° F.; 30 lb. of fresh quicklime (broken just before use into lumps as big as the fist) was then thrown in and allowed to disintegrate without being touched or stirred up in the liquid; 30 lb. of sulphur was then added. The sulphur (which contained 2 per cent. of $CuSO_4$ and was the same as that used against vine mildew) was added by degrees, being dropped through a sieve; the presence of copper does not however appear to be essential. The sieve had two long handles and the workman wore protective goggles. As soon as the sulphur was added, the mixture was well stirred until a homogeneous paste was formed in about 15–20 minutes, 30 gallons of water being then poured in and the whole boiled for about an hour and a half, when the mixture was ready. At first it contained impurities in suspension which gave it the colour of roasted coffee, but with a green tinge. After the sediment had formed, the clear liquid was red-brown in colour. At a temperature of 68° F. its density was about 1·21. The flour paste adhesive was prepared as follows: In a boiler of the size given above, 30 gallons of water were heated to 122°–159° F. and 30 lb. of wheat flour (free from bran) was dropped in through a sieve by one workman while another stirred without ceasing in order to prevent the formation of lumps. Stirring was continued, and after a few minutes the fire was raked out to prevent an excess of froth; a few minutes later stirring was discontinued and the liquid was allowed to cool. It contained about 10 per cent. of flour. The polysulphide of calcium may be prepared a long time before use, but the paste solution goes bad quickly and should not be made and mixed with the polysulphide earlier than the day before that on which spraying is performed. As the spray solution must contain 2 per cent. of flour and the paste contains 10 per cent. of flour, it is only necessary to pour a convenient quantity of paste solution into a tub, then add the proper quantity of polysulphide, and finally dilute with water until the total bulk of liquid is five times that of the paste solution; the spray is then ready for use. The presence of 2 per cent. wheat flour changes somewhat the physical characteristics of the polysulphide solution and renders it turbid. The solution of calcium polysulphide was found to be very frothy if decanted with a certain violence, and this frothiness persists even when the strength of the solution is reduced to 5 per cent. by adding water. The solution is not hygroscopic until the paste is added, when the mixture becomes so to a slight degree.

The potassium polysulphide used in the experiments was in the form of tiles weighing about 2 lb. each. These were very hygroscopic, and if broken up small, they dissolved quickly even in cold water. In the experiments a 33⅓ per cent. solution was produced by dissolving 10 lb. of potassium polysulphide in 2 gals. of water and then diluting up to 3 gals. of liquid. This stock solution was kept in tightly closed glass bottles; at a temperature of 58° F. its density was 1·23. Both the 2 per cent. and 8 per cent. working strength were less frothy than those of polysulphide of calcium, even with the addition of the boiled paste. Strong solutions, such as 5 per cent. and 7 per cent., were very viscid to the touch owing to their alkalinity, and they somewhat affected the skin. They never damaged the rubber hose, whether cold or hot. In cases where the calcium and potassium polysulphides were mixed, flocculent tufts were formed—even when the two solutions were clear before mixing. Though the mixture was somewhat viscid, it did not stick to the citrus leaves and therefore required the addition of the paste. With such an addition, it yielded on drying a coating which was highly resistant to atmospheric agents, and this property is the more marked when the polysulphide of calcium is predominant. For instance, a spray containing 2 per cent. of polysulphide of potassium, 4 per cent. of the concentrated solution of polysulphide of calcium and 2 per cent. of flour, was very adherent to the foliage and resisted well the action of rain. The leaves of citrus plants are able to resist chemical action to a considerable extent, and in December calcium polysulphide was safely applied at a strength of 14 per cent.; in summer 5 per cent. was found to scorch the young fruit if applied in the hot hours of the day, but not at other times. The potassium polysulphide was variable in action according to the dampness of the atmosphere, the temperature being a less important factor; in July a 7 per cent. solution destroyed the Coccids and did little damage to leaves or fruit. In autumn, however, the same dose injured many leaves and fruit, and a dose of 2 per cent. of the solution containing both polysulphides also proved injurious. In no case should the polysulphides be applied when the citrus plants are in blossom. Even at doses of 3 or 4 per cent. polysulphide of potassium had a very powerful and comparatively prompt action on the Coccids. The males were even more sensitive to it than the females, and the nymphs succumbed very quickly; to mobile larvae a dose of 0·4 per cent. proved fatal. The immunising action of polysulphide of potassium was also very strong and lasting, unless there was rain. Polysulphide of calcium behaved in a very different manner. Its action on the Coccids, though efficient, was much slower. In the early nymphal forms the mortality was ascertainable after 8–10 days, but with the adults a 5 per cent. dose required a fortnight or more to reveal its efficiency. Spraying should be done from June to September and after harvesting the crop, up to early in March. In the experiments good results were obtained both in summer and winter, but in Sicily the summer is preferable as rains are then less frequent, while winter treatment may mean several applications and a waste of material. In summer, with maximum temperatures of 104° F., two applications of 5 per cent. polysulphide of calcium removed all infestation. If the applications were put off until the crop had been gathered, a stronger dose of 7 or 8 per cent. was necessary. If the weather was not rainy

an interval of seven or eight days, never more than ten, was allowed between the applications. This comparatively short interval was made possible by the great immunising power of the covering film, especially that left by the second application, which prevented attacks by larvae from the few surviving adults. It is most important that the spray should not be stinted, as a uniform coating is the object aimed at. The spray-nozzle should be at an angle of 45° to the rod.

This method of control was found to be cheap: 22 gals. of concentrated polysulphide of calcium solution cost about 3*s.* 10*d.*, the requisite paste—containing 73 lb. of wheat flour—costing 6*s.* 6*d.* (including 1*s.* 1*d.* for fuel and labour). Twenty-two gallons of concentrated spray therefore cost 10*s.* 4*d.* and yielded 367 gallons of 6 per cent. spray, a quantity sufficient for one application to 333 eight-year-old trees about 8 feet high and 7 feet in diameter. At the rate of about 2*s.* per diem, the necessary labour for one application to 333 trees (40 per diem) cost about 16*s.* 6*d.*, so that the total cost for one application per tree was under 1*d.* This method would seem to replace with advantage that of fumigation with hydrocyanic acid gas.

MacMillan (H. F.). **A Handbook of Tropical Gardening and Planting with special reference to Ceylon. Second Edition, 1914,** *Colombo,* H. W. Cave & Co., x+662+xxxv pp., 264 figs. Price 13*s.* 4*d.*

Detailed information as to the trees and plants grown in tropical countries, and as to the methods of cultivation adopted, is of great value to economic entomologists, as it facilitates an understanding of the conditions under which insect pests occur. This work, though primarily dealing with Ceylon, contains a great mass of information on this subject very difficult to obtain elsewhere without reference to a large number of books. The scientific and local names of plants are given with all necessary details as to cultivation, while the chapters on the standard and economic products of Ceylon are full of interesting information. The 13 pages devoted to insect pests and preventive or remedial measures are unfortunately not of the same standard as the rest of the book. The tabular list of pests, which occupies more than four pages, is so full of typographical errors as to render many of the insect names unrecognisable. Among the remedies, arsenate of lead is described as sugar of lead (lead acetate) and the information given under this head is exceedingly scanty and incomplete, and it is to be hoped that in any future edition of this otherwise excellent book this section will be thoroughly revised and extended.

Copeland (E. B.). **The Coconut.** *London,* MacMillan & Co., 1914, xiv + 212 pp., 23 plates, price 10*s.* net.

Regarded on botanical grounds as of tropical American origin, the cultivation of the coconut has now spread over the tropical regions of the whole world, and in many small islands it is a crop of the first importance. A reliable book on the whole subject is therefore valuable, especially as the author devotes one-third of his pages to a careful discussion of diseases and pests of this palm.

Perhaps the most serious of the diseases affecting the coconut are those due to fungi. The most dangerous of these is the

widely distributed bud-rot, which according to Macrae is chiefly spread in Madras by palm climbers and to a less extent by palm weevils and rhinoceros beetles, and occasionally by the wind and by birds. The destruction of coconut beetles is one of the methods of restricting the spread of the disease; the ruthless burning of all infected trees appears to be the only satisfactory remedy.

Oryctes rhinoceros, which is one of the most serious coconut pests, ranges from India to the Dutch Indies and the Philippines and is represented in Africa by a number of related species having the same habits. *O. augias*, Ol., *O. colonicus*, Coq., *O. insularis*, Coq., *O. pyrrhus*, Burm., *O. ranavalo*, Coq., and *O. sinnar*, Coq., occur in Madagascar; *O. boas*, F., *O. monoceros*, Ol., and *O. cristatus*, Snell., in East Africa; and *O. preussi*, Kolbe, in New Guinea. The rhinoceros beetle has no immediate relative dangerous to the coconut in the American tropics, although an American species of *Oryctes* attacks another palm. *O. rhinoceros* attacks several other palms as well as the coconut, including *Elaeis* (oil palm), *Borassus* (Palmyra palm), *Roystonia* (royal palm), *Nipa*, *Corypha*, and perhaps *Areca* (betel palm). Systematic catching of these beetles has been practised for many years in the Federated Malay States and in Ceylon, and the Straits Ordinance No. IV. of 1890 on the subject is given in extenso.

The red weevil, *Rhynchophorus ferrugineus*, Ol., and its larva is described and figured. It is stated that the palms become susceptible to attack when mechanically injured or burned by man, when previously attacked by other insects, or when damaged by storms. The cutting away of all dead matter from the crown and all hanging leaves, which was formerly practised, is now recognised to have been a costly mistake, as the resulting wounds provide further opportunities of oviposition for the beetles. *Oryctes* can enter a sound tree, while *Rhynchophorus* cannot, hence injury by the former assists attack by the latter and therefore the destruction of *Oryctes* is an excellent preventive measure against *Rhynchophorus*. The method of scorching for bud-rot, as practised in Cuba, is regarded as likely to favour the increase of *R. palmarum*, L. Grass fires in the plantations in the Philippines have been observed to be followed by an increase of these weevils, and in one plantation every tree scorched by the fire was dying at the end of eight months from beetle attack. Destruction of attacked trees is strongly recommended, as they only serve as centres of infection if left standing; burying is unsafe against *Oryctes*, and submergence, though preventing oviposition, will not always prevent the escape of mature beetles. Traps of infested wood from which the beetles have been removed, or freshly cut and split pieces of palm wood, are used with success as traps in tropical America. In British Honduras, according to Leay, the "salt water pimento" is used as a trap; this is cut off just above the cabbage and a hole is cut in the latter into which the beetles creep; such a trap will last a week or two and should then be destroyed. Examples of *R. palmarum* are said to fly three or four miles in search of a sickly tree or one just beginning to bear, though this is on the whole a less serious pest than *R. ferrugineus*.

Among minor pests are the following weevils. In the Philippines a species of *Cercidocerus* [erroneously identified by C. S. Banks as a *Cyrtotrachelus* (Phil. Jl. Sci. i, pt. 1, 1906, p. 161)], a common enemy of the betel-nut palm, sometimes attacks sound or at least apparently

healthy coconuts, usually those about to come into bearing; two other weevils, the shot-hole weevil and the four-spotted weevil [*Diocalandra frumenti*, F.], though attacking the trees, are said to be rarely the cause of direct injury. *Rhabdocnemis* (*Sphenophorus*) *obscurus*, Boisd., which is specially a pest of sugar-cane, damages coconuts by burrowing into the leaves. *Metamasius hemipterus*, L., *M. cinnamominus* and a species of *Rhabdobaenus* may be dealt with in the same way as *R. palmarum*. The bearded weevil, *Rhina barbirostris*, F., attacks mature trees but not the younger ones, the larvae boring into the hardest part of the stems. *Diocalandra frumenti*, F. (*Calandra taitensis*, Guér.) is a serious pest in the Society Islands, boring in the edge of the base of the leaf stem, and often at the base of the leaflets, many of which are thus destroyed. Among Lamellicorn beetles, *Strategus titanus*, F., is found in the inflorescence of coconuts in Cuba, and though locally regarded as a pest, is believed by Busck to be harmless. *S. anachoreta* bores a hole in the ground near the stem of a young tree, generally one about two years old, and if not removed in time, one beetle is sufficient to destroy a tree; the larvae live in rotten wood, this stage lasting three or four years. *Xylotrupes gideon*, L., *X. nimrod*, Voet, and *X. lorquini*, Deyr., behave in much the same manner as *O. rhinoceros* and may be controlled in the same way. The larvae of *Chalcosoma atlas*, L., have been stated to attack the trunk. *Scapanes australis*, Boisd., and *S. grossepunctatus*, Sternb., destroy two to three-year-old trees in New Guinea; four species of *Pimelopus*, *Camelonotus nasutus*, Bates (*quadrituber*, Fairm.), and *Oryctoderus latitarsis*, Boisd., also damage coconuts in New Guinea. The adults of *Eurytrachelus pilosipes*, Waterh., bore into the stem under the shelter of the base of the leaf stalk and *E. intermedius*, Gestr., is also recorded as a pest. *Passalus tridens*, Wied.,* is reported as having done much damage in Demerara. In the Seychelles and Madagascar, *Melitomma insulare*, Fairm., is, according to Barnett, a most important pest, attacking the trunk. Scolytid beetles are common in Cuba and are suspected of causing both direct and indirect damage, chiefly by providing places for infection by fungi or oviposition by the palm weevil. Leaf-eating beetles of the family HISPIDAE are serious local pests and *Brontispa froggatti*, Sharp, is possibly the worst pest that the planters of the Solomon Islands have to contend with; both adult and larva feed on the leaves [see this *Review*, Ser. A, iii, p. 27]; the same or a closely related insect is a serious pest in Eastern Java. Three species of *Promecotheca*, *P. cumingii*, Baly, in the Philippines, *P. antiqua*, Weise, in New Guinea, and *P. opacicollis*, Gestr., in the New Hebrides, are known as pests of the coconut. In New Guinea, palms standing among alang-alang grass (*Imperata cylindrica*) are specially liable to attack, and the beetles seem to disappear when the grass is eradicated.

Lepidopterous pests are only local; they include:—the Zygaenid, *Brachartona catoxantha*, Hmp., in the Dutch East Indies and the Federated Malay States; the Hesperid, *Hidari irava*, on the west coast of Sumatra; the Hesperid, *Padraona chrysozona*, Plötz, and the Limacodid, *Thosea cinereomarginata*, in the Philippines and Federated Malay States, and the butterfly, *Amathusia phidippus*, L.,

[* It is probable that *P. interruptus*, L., is the beetle concerned, *tridens* being a Javanese species.—ED.]

in the Philippines, India and the Dutch East Indies. In Panama, another butterfly, *Brassolis isthmia*, G. & S., does great damage and defoliates the palms in large numbers; the larvae feed at night and at dawn retire to a tough nest shaped like a narrow bag, from 1½ inches to 2 feet long, in which 700 or more are often crowded together; as many as four nests are sometimes found in one tree. In Trinidad, *B. sophorae*, L., does a great deal of damage by skeletonising the leaves [see this *Review*, Ser. A, ii, p. 569 and iii, pp. 175, 368 and 591]. The Pyralid, *Nacoleia* (*Omiodes*) *blackburni*, Butl., has been reported on coconuts in Hawaii and is also known in New Guinea.

Locusts will attack coconuts when other food is not available and sometimes do great damage. *Graeffea cocophaga*, Newp., a large Phasmid, which occurs from New South Wales northwards and eastward across Polynesia, feeds on coconuts and has done great temporary damage in Samoa and on Hervey Island. Among scale-insects, the worst pest is *Aspidiotus destructor*, Sign., which has caused great loss in the Caroline Islands and in the Philippines; drought favours it and at the same time weakens the trees, while ample spacing, water and cultivation and manuring of the trees limit its ravages. No less than 31 species of scale-insects attack and damage the coconut palm to a greater or less extent. *Aleurodicus cocois*, Curt., the coconut whitefly, has been long known in the West Indies, and *A. destructor*, Quaint., has recently been reported as a serious pest in a limited area in the Philippines. A table is given of 70 insect pests of the coconut, the countries in which they are found, the nature of the damage done, and the treatment required, but, as the author says, this by no means exhausts the enemies of the coconut. References to these and many others occur in papers already abstracted [see this *Review*, Ser. A, i, pp. 129, 285, 425; ii, pp. 2, 26–28, 29, 98, 490, 689–691; iii, pp. 13, 27, 83, 315, 439, 492, 558, 591, 679, 690, 695, 713, 724].

FAWCETT (W.). **The Banana, its cultivation, distribution and commercial uses.** *London*, 1913, Duckworth & Co. x + 287 pp. 8 plates, 10 figs., price 7*s*. 6*d*.

This comprehensive monograph contains a large mass of useful and well arranged information. The commercial aspects of the banana are very fully dealt with, and in the 80 pages devoted to general information, details are given as to the cultivation and handling of the banana in every country in which it is grown. A short description is given of no less than 66 species of *Musa* and there are chapters on bananas as food, on alcohol and wines derived from bananas, and the methods of drying the fruit for flour. Sixteen pages are devoted to fungus diseases and half as much to insect pests.

The banana weevil borer, *Cosmopolites* (*Sphenophorus*) *sordidus*, is said to cause an annual loss in Fiji of many thousands of pounds and is most difficult to deal with, as its whole life is spent in the underground stem or in the soil. Young suckers wither and die, and the first evidence of attack is the death of the young leaves while still unrolled; when cut open, the "bulb" is found to be riddled by the larvae; older plants do not seem to be so seriously affected. The adult weevils are found in quantity in the soil round the roots and also sheltering under dead leaves at the base of the stem. The eggs are believed to be deposited

singly on the base of the stem about half an inch above the level of the soil. The larval stage lasts about 20 days and the pupal stage 6–8 days. The length of life of the adults is not known but they will live in dry earth for three months without food, and not longer than 17 weeks with food; crop rotation and very clean cultivation are suggested as remedies and parasites should be utilized if they can be found. [*C. sordidus* is found in banana-growing areas in the Old World tropics from Madagascar eastward to Fiji, as well as in Brazil and the West Indies.] A common West Indian species is *Metamasius* (*Sphenophorus*) *sericeus*, while *S. liratus* occurs in Martinique; *Rhabdocnemis* (*S.*) *obscurus* in Papua, the Sandwich, Solomon and Society Islands attacks bananas as well as other plants, while in Queensland it only attacks sugar-cane, *Ligyrus ebenus* (*Tomarus bituberculatus*) damages the leaves in the West Indies and tropical America, the burning of badly attacked leaves being the best remedy. In South America and Trinidad the larva of a large moth, *Castnia licus*, bores in the stem of bananas as well as of sugar-cane. The so-called banana "scab" in Fiji is due to the larvae of a small moth [*Nacoleia octosema*, Meyr., also recorded from Java and Queensland]; minute longitudinal cracks are found on the incurved side of the fruit, and these increase in size and may extend to the edible portion, which then begins to decay; dusting with pyrethrum powder is recommended against it. In New Zealand the ripe-rot fly, *Drosophila ampelophila*, attacks all kinds of fruit in warm weather, whether growing or cut. The fruit-fly, *Dacus ferrugineus* F. (*tryoni*, Frog.), punctures the skin of the unripe fruit and oviposits in the hole made; a black spot results, and the larvae burrow into the pulp and set up decay; when only a few days old the larva passes out of the fruit and drops to the ground to pupate. Tryon recommends the eradication of breeding grounds near banana plantations, and the destruction of bananas and all other infested fruit, as well as of all wild fruit trees. In South Australia the use of woven covers was formerly compulsory and is effective if applied when the fruit is two-thirds grown. Another fruit-fly, *Dacus curvipennis*, has been bred by Froggatt from bananas shipped from Suva, though no specimens have actually been found in Fiji. In Surinam small black bees, in searching for honey, scar the very young fruits and render it unsaleable when full grown. One estate lost 15,000 bunches from these attacks in one year.

PATTERSON (J. T.). **Observations on the Development of** ***Copidosoma gelechiae*****.**—*Biol. Bull., Marine Biol. Laboratory, Woods Hole, Mass. Lancaster, Pa*, **xxix**, no. 6, December 1915, pp. 333–360, 6 plates, 6 tables. [Received 19th February 1916.]

Copidosoma gelechiae, a Chalcidoid parasite of a Microlepidopteron, *Gnorimoschema salinaris*, has one generation annually. The egg of the parasite is probably laid within the host during May. Early development takes place beneath the hypodermis of the host; in later stages the larvae enter the body cavity, where they continue to feed until the entire contents are destroyed. The pupal stage of the parasite is reached during the first ten days of August and lasts about a month. The number of adults emerging from one host larva varies from 25 to 395; about 55 per cent. of all broods are females.

GIRAULT (A. A.). **Australian Hymenoptera Chalcidoidea vii–xiv.**—*Mem. Queensland Museum, Brisbane*, iv, 4th June 1915, 365 pp. [Received 25th February 1916.]

This volume contains descriptions of representatives of the following families of Chalcidoidea :—ENCYRTIDAE, MISCOGASTERIDAE, CLEONYMIDAE, EUCHARIDAE, EURYTOMIDAE, CALLIMOMIDAE, AGAONIDAE and CHALCIDIDAE, including many species of economic importance.

RITCHIE (A. H.). **Insect Pests on Tobacco.**—*Jl. Jamaica Agric. Soc., Kingston*, xix, no. 11, November 1915, pp. 429–433. [Received 28th February 1916.]

For the control of cutworms, poisoned bait prepared according to the Kansas formula is recommended. Cultural operations carried out well in advance of the crop will destroy pupae in the soil. The tobacco horn worm (*Protoparce*) can be controlled by the application of a mixture of Paris green and lime in equal parts or one part Paris green to three or four parts of lime. Against the larvae of flea-beetles, attacking the roots of seedlings, a strong solution of lead arsenate (1 lb. in 12–16 gals. water) is effective. The cigarette beetle, *Lasioderma serricorne*, which attacks stored tobacco, is controlled by fumigation with carbon bisulphide, allowing 4 lb. to 1,000 cubic feet for an exposure of 48 hours.

H. A. B. **Dangerous Hard-Backs.**—*Agric. News, Barbados*, xv, no. 359, 29th January 1916, pp. 42–43, 5 figs.

Lachnosterna patruelis (brown hard-back) occurs in St. Kitts as a pest of sugar-cane. It is believed to be of importance as a root feeder and may be connected with attacks of root fungus. The larvae are attacked by a Hymenopterous parasite. In Antigua a species of *Lachnosterna* frequently causes serious injury to sugar-cane and has also been recorded on onions and maize. The roots and bases of the stems of both young and ripening plants are attacked. Related insects occur in other islands, including *Phytalus smithi* in Barbados and Mauritius, *Strategus titanus* in St. Croix and Porto Rico, and *Ligyrus tumulosus* throughout the West Indies. *L. rugiceps* is a pest of sugar-cane and maize in the southern United States ; *S. anachoretus* attacks coconuts and sugar-cane in Trinidad, and *Dyscinetus barbatus* is believed to injure crops in Barbuda. In addition to the control exercised over hard-back larvae by natural enemies, of which the Scoliid wasp, *Tiphia parallela*, is the most important, and the use of poisoned bait, the control of the insects depends on the collection of larvae and adults and purely agricultural methods.

WEBSTER (F. M.). **The Spring Grain Aphis or "Green Bug" in the South-west and the Possibilities of an Outbreak in 1916.**—*U.S. Dept. Agric., Washington, D.C.* Circ. no. 55. 5th February 1916, 3 pp., 3 figs.

Toxoptera graminum is present in grain fields in Tennessee, Texas, Oklahoma, Kansas and north-eastern New Mexico, and probably also

(C259) Wt.P1/106. 1,500. 5.16. B.&F.Ltd. G.11/3.

in southern Missouri and Arkansas. Recent outbreaks have originated in fields of early sown wheat or in wheat which follows an oat crop, there being a growth of self-sown oats present among the wheat. The extent of the damage caused by this insect depends largely on the weather conditions prior to the middle of April. If the temperature is high enough to enable the Aphids to breed throughout the winter and at the same time is too low for the development of their natural enemy, the Braconid, *Aphidius testaceipes*, a serious outbreak over a large area may be expected. In the more northern states *T. graminum* passes the winter in the egg-stage, and the numbers are not likely to increase sufficiently in the spring to cause serious injury. Areas affected are recognised by the colour of the wheat changing from green to yellow and should be ploughed deeply and then rolled. Self-sown grain should, if possible, be destroyed by grazing in late autumn or early winter, as this measure destroys the initial breeding grounds both of this pest and of the Hessian fly, *Mayetiola destructor*.

POETEREN (N. van). **Het Gebruik van Carbolineum bij de Bestrijding van Schadelijke Dieren.** [The use of Carbolineum for the control of animal pests.]—*Tidsch. Plantenziekten, Wageningen*, xxii, pt. 1, January 1916, pp. 1–36.

In the last three years the use of carbolineum for the control of insect pests has greatly increased and the results have been good. As a contact poison, it is economical in use and of wide application; there is also reason for hoping that it may prove useful against fungus diseases. It has been tried and found useful as a spray for orchard and bush fruit, though care must be exercised in the case of certain kinds, such as peaches. Aphids, Coccids and the larvae of many Lepidopterous and other pests are destroyed by it. It appears to be an excellent general insecticide for flowers under glass, especially roses, a 5 per cent. solution in water being sufficient for this purpose; *Typhlocyba rosae* is controlled by it. A list of 13 species of *Abies* and 20 of *Picea* is given, which were sprayed respectively with a 7½ per cent. and a 3 per cent. solution without harm to the trees and with apparently good results. The common pest of azalea nurseries in Holland, *Phyllocoptes azaleae*, can be controlled by a carbolineum spray. Against *Psylla buxi* it may be used as a preventive, but it is not effective against *Monarthropalpus buxi* or *Phytomyza ilicis*. It cannot be used against white fly (*Aleurodes*) on Japanese azaleas, as the plants themselves are damaged. Dressing the trunks with carbolineum solution will prevent the growth of moss and lichen on trees, and it has proved a very efficient dressing against canker when used in 25 or 50 per cent. solutions. Generally speaking, plants will bear a much stronger solution of carbolineum than is necessary to destroy the pests on them. An 8 per cent. solution, if properly used, is sufficient for orchard trees and bush fruit; a 10 per cent. solution seems to be necessary against *Eriosoma lanigerum*, but nothing stronger than 5 per cent. must be used for peaches. It has been stated that carbolineum has a directly beneficial effect upon the plants sprayed with it, but the author denies this and considers that, though no harm is done, there is some evidence of a retarding action on the growth in the spring, especially in the case of species of *Buxus*. Conifers can only be sprayed late, at the end of

April; *Buxus* spp. and other more sensitive evergreens, as well as deciduous trees generally, should be sprayed in February or the beginning of March.

With regard to treatment of the soil itself with carbolineum, it has been shown that when used against *Incurvaria rubiella* on raspberries and allowed to soak into the soil around the plants, the larvae in the soil were killed without damage to the canes [see this *Review*, Ser. A, iii, p. 643]. As however the soaking of the soil with a powerful disinfectant of somewhat variable composition might have a bad effect directly or indirectly, experiments were made on a piece of ground divided into five plots. The whole area was sown with rye, wheat and peas, a strip being kept untreated as a control. The remainder was sprayed with an 8 per cent. carbolineum solution with an automatic machine delivering 20 cc. per second, the five plots in order being sprayed for 5, 10, 15, 20 and 25 seconds. This spraying was done on 3rd April in damp, warm weather and the penetration of the solution into the soil was complete. The seed had germinated before being sown. The general result of the experiments was that 1 litre of 8 per cent. carbolineum solution per square metre (a little over 3 oz. per square foot) killed but very few of the germinating seeds, though the green leaf was damaged. The peas apparently did not suffer at all, and it is considered that, at this strength, the dripping from sprayed trees and bushes on to the soil can do no appreciable harm. These experiments are to be repeated and extended.

DAMMERMAN (K. W.). **On a new species of *Calotermes* (*C. tectonae*, nov. sp.), which attacks living teak trees.**—*Tidschr. voor Entomologie, The Hague*, lviii., 1915, pp. 98–100, 2 plates. [Received 23rd February 1916.]

The author's attention was called by the forest service of Java to a peculiar disease of teak trees near Samarang. The damage done was found to be due to a termite which resembles *C. assmuthi*, Holmgr., and is described under the above name. This termite, which has only been found on living teak trees, lives inside the stem of 20 to 30-year-old examples at a height of 10–20 feet; on this spot the stem is swollen and the bark cracked. On the same tree three or more swellings sometimes occur. If the wood be slit, several tunnels, partly covered with excrement, are found; these do not extend much further than the swollen part of the stem. Sometimes the tunnels of two swellings are connected, but they never run towards the base of the tree. They communicate with the exterior by narrow openings. The tunnels are first made between the bark and wood, causing the peculiar deformations, and later extend to the heart-wood. Towards the end of the dry monsoon all stages were found inside the stem, and at the beginning of the rainy monsoon, in November and December, the winged forms swarmed. How the trees are attacked in the first instance is uncertain, but in older tunnels pairs were found with shed wings, and it was also found experimentally that the larvae are capable of boring into the living wood. Probably the sexual pairs are permitted to enter already existing nests. The damage caused by this pest is of great importance, 75 per cent. of the trees being infested in some places. The trees often break near the swellings and in any case the value of the timber is considerably reduced.

SCHRIBAUX (E.). **La Résistance des Semences à la Chaleur et la Destruction des Insectes.** [The resistance of seeds to heat and the destruction of insects.]—*Bull. Soc. Nat. Acclimat., Paris*, lxiii, no. 2, February 1916, pp. 63–64.

Investigations carried out by the author in collaboration with M.M. Bussard and Etienne have shown that insects infesting seeds are easily killed by heat without any resulting injury to the seeds. Weevils are destroyed in two minutes by a temperature of 122° F., and *Bruchus* spp. at 140° F. Cereals, except maize, can withstand a temperature of 212° F. for an hour without their germinating power being affected.

GRASSI (B.). **Modern Views of the Control of the Vine** ***Phylloxera***.—*Mthly. Bull. Agric. Intell. Plant Dis., Rome*, vi, no. 12, December 1915, pp. 1553-1571. [Received 1st March 1916.]

Methods for the control of *Phylloxera* may be classed under three heads:—(1) prevention or diminution of the spread of the insect; (2) the use of insecticides, especially carbon bisulphide, and flooding; (3) cultural measures, enabling the vine to live in infested localities, e.g., planting in sand or grafting European vines on American stocks.

The spread of this pest in Apulia and Sicily has been extremely rapid, whereas in other parts of Italy, such as the Abruzzi, Umbria and portions of Tuscany, the progress of infection has been very slow. The results of a campaign against the pest in the first two districts have been most successful, while in the last three all efforts have been practically useless. These facts have led in some cases to a denial of the efficacy of the control measures adopted. In spite of adverse results and criticisms, the author maintains the opinion that the campaign against *Phylloxera* should on no account be abandoned. Certain data are given which show that defensive and constructive measures are capable of being adopted with success. In the Canton de Vaud, which is given as an example, the discontinuance of such measures would mean the complete destruction of all the European vines in that district. Although its protection has cost more than £160,000, the present gross return of £26 3*s*. 6*d*. per acre, a sum far superior to the returns from Italian vineyards, has justified this expenditure. If the campaign were carried out on a similar scale in Italy, the cost would be not less than five millions annually, but the advantages which would accrue would be such as to encourage the employment of an even larger capital.

The following conclusions have been reached by Prof. de Benedetti as the result of his campaign against *Phylloxera* at Oliva Gessi (territory of Voghera) between 1912 and the present time:—(1) defence is useful both at the outset and in advanced stages of infection; (2) reconstitution should be prepared, conducted and completed in such a way as to obtain a sufficient quantity of grapes to cover the interests of both proprietor and cultivator; (3) defence and reconstitution carried out on these lines allow of the slow conversion of part of the land under vines into land producing cheaper crops. Vines would only be allowed to occupy that particular land in which local or special conditions ensure a less uncertain industrial profit than the one hitherto obtaining.

The manner of dispersal of *Phylloxera* may be either natural or artificial. Natural dispersal is caused by winged forms, newly-hatched examples which may or may not emerge from the soil, or neogallicolae. The winged form may be neglected when European vines are considered [see this *Review*, Ser. A, iii, p. 765]. The migration of newly-hatched forms which emerge from the soil explains the occurrence of new outbreaks at a greater or less distance from larger centres. With regard to distribution by gallicolae, it is pointed out that galls spread easily between closely-set vines, either actively, if the branches interlace, or by means of the wind, which carries away the neogallicolae-gallicolae when the latter are searching for a suitable place for fixation. The neogallicolae-radicolae drop to the ground and behave in a manner similar to the neoradicolae which emerge from the soil. In slightly infested regions the appearance of galls may contribute to the spread, but in districts which are severely attacked the effect of the galls cannot be compared with that of the neoradicolae.

Artificial means of dispersal are the following:—(1) earth adhering to the boots, etc., of labourers; (2) birds, especially fowls, sheep, pigs, etc., which may carry earth infested by *Phylloxera*; (3) agricultural implements; (4) plants growing between the vines or used as props; (5) manure; (6) water-courses; (7) vine-cuttings; (8) rooted plants. The insect cannot survive over-night, except on very damp clothes; in the cool, damp days of spring and autumn they may survive long enough to be carried to an immune vine if occasion offers. Implements such as spades, etc., rarely carry the insect for any distance, owing to the clean state in which they are kept by the peasants. The plough is important as a means of dispersal, since it carries infected roots for some distance and may drop them near clean plants. Labourers while at work, often wear old boots with broken soles in which damp earth may collect and where migrating individuals may live for several days. Potatoes planted between the vines apparently do not aid in dispersal. Rain, if accompanied by strong winds, undoubtedly carries infected soil, newly-hatched forms, leaves bearing galls, etc., into clean vineyards. On hilly ground, dispersion is effected by torrents or streams. Vine-cuttings do not appear to harbour either winter-eggs or hibernating insects, nor do rootlets given off from the shoots of American vines seem to be a source of danger. Rooted plants may introduce the insect into hitherto clean zones and have been the cause of the destruction of the finest Italian vineyards.

The methods of control proposed differ considerably from those previously followed. It is suggested that the vine-growing parts of Italy be divided into suitable districts, in which the cultivators, working under an expert, take the necessary steps to prevent the introduction of *Phylloxera* or prevent its spread if the vineyards are slightly infested. At the same time, the reconstitution of vineyards should be effected. Inspection should be carried out personally by the grower, and such inspection should be avoided on damp, windy days. The production of superficial roots should be reduced wherever *Phylloxera* exists or is suspected of existing. The chief object should be the discovery and prevention of spreading of new outbreaks. Efforts in the second of these directions should be preceded by watering the ground with a 1-2 per cent. solution of creoline on the previous evening. This

watering should also be performed before harvest in infested centres which are to be destroyed. The introduction of rooted plants into clean districts should be prohibited; when intended for planting in a zone of limited infection, rooted plants should be disinfected before being removed from the nursery. The method of disinfection used in Italy, namely, total immersion in water heated to 131° F. for five or ten minutes, is not absolutely innocuous. Immersion of the underground part in a 3 per cent. solution of potassium sulpho-carbonate and a 1 per cent. solution of soft soap for 12 hours gives the desired result.

In conclusion, it is pointed out that in Italy, although excellent seed-vines have been selected (Longo) and equally good hybrids have been obtained (e.g., some sorts of Ruggeri), up to the present time stocks of French origin have been used almost entirely in the reconstitution of vineyards.

A short bibliography is appended.

SAVASTANO (L.). **La manipolazione della poltiglia solfo-calcica. (Formola della Stazione di Agrumicoltura.) 3a edizione.** [The preparation of lime-sulphur mixture. (Formula of the Station for Citrus Culture.) 3rd edition.]—*Boll. R. Staz. Speriment. Agrum. Fruttic., Acireale*, no. 15, October 1914, 14 pp., 1 fig. [Received 2nd March 1916.]

This third edition is essentially the same as the original one [see this *Review*, Ser. A, ii, p. 412], but contains additional details and advice suggested by three years' working. A figure and description are given of the Savastano densimeter specially designed for use with the lime-sulphur mixture. Two parallel scales are provided, one for densities from 1·13 to 1·37 and the other for percentages from 8 to 2 per cent. The density of 1·25 is taken as a standard, the percentage figure against it being 5. If a normal strength spray is required, a stock of 1.25 density should be diluted to a 5 per cent. solution. If the density is the greater one of 1·29 (mark 4 on the percentage scale) the stock should be diluted to a 4 per cent. solution in order to yield a spray of equal strength. The latter will also be produced by a 6 per cent. solution of stock of the lesser density 1·21 (mark 6 on the percentage scale). When a spray of a strength other than the normal 5 per cent. is required, the density of 1·25 is still retained as a standard, and if the stock has that density it only needs diluting to the new percentage—in other words, the figure 5 is replaced by the new percentage figure. With stock of greater or less densities the procedure described above is followed, but the percentage figures on the scale must be modified in the same degree as the new percentage figure differs from the figure 5. If, for instance, a spraying strength of 8 per cent. (3 more than 5) is required and the stock has a density of 1·29, then it must be diluted to 7 per cent. (3 more than 4).

POMA (D.). **L'olivicoltura nel circondario di Trapani.** [Olive culture in the Trapani district.]—*Annali R. Staz. Speriment. Agrum. Fruttic. Acireale*, iii, 1915, pp. 111–134. [Received 2nd March 1916.]

This account of the cultivation of the olive in the district of Trapani (Sicily) aims at giving full data with a view to encouraging its

extension there. The insect pests mentioned are *Dacus oleae*, Gmel., *Hylesinus oleiperda*, F., and *Saissetia* (*Lecanium*) *oleae*, Bern. In the control of *D. oleae*, the De Cillis formula for poison bait [see this *Review*, Ser. A, i, p. 271] gave the best results; predatory Coccinellids such as *Chilocorus* and *Exochomus* are not sufficiently numerous, so that poisons are the only means of control. A bibliography of 15 works is appended to this paper.

FARACI (G.). **La coltivazione del limone in S. Agata di Militello (Prov. di Messina).** [The cultivation of the lemon at S. Agata di Militello (Province of Messina).]—*Annali R. Staz. Speriment. Agrum. Fruttic., Acireale*, iii, 1915, pp. 135–192. [Received 2nd March 1916.]

This paper deals with lemon cultivation in the district of S. Agata di Militello, in Sicily. The insect pests noticed are *Pseudococcus citri*, Risso, *Aspidiotus hederae*, Vall., *Lepidosaphes beckii*, Newm. (*Mytilaspis citricola*, Pack.), *Heliothrips haemorrhoidalis*, Bch., and *Prays citri*, Mil. *Tetranychus telarius*, L., occurs in connection with red rust. The usual remedies are given.

Real orden del Ministerio de Fomento del 17 de enero 1916. [Royal order issued by the Ministry of Agriculture on 17th January 1916.]—*Boletín de Agricultura técnica y económica, Madrid*, viii, no. 85, January 1916, p. 2. [Received 3rd March 1916.]

This order instructs the Civil Governors of provinces where olive cultivation is carried on, to compel the growers to burn olive prunings or to remove them from the ground for storage in rooms which must be kept closed.

El sistema Berlese contra la mosca del olivo.—Su utilidad para la extinción de otras plagas del campo. [The Berlese method against the olive fly and its utility in destroying other agricultural pests.]—*Boletín de Agricultura técnica y económica, Madrid*, viii, no. 85, January 1916, pp. 83–85.

The provincial council of agriculture of Tarragona experimented on 3,000 olive trees in an area of 250 acres with Prof. Berlese's method against the olive fly (*Dacus oleae*) [see this *Review*, Ser. A, iii, p. 36] and good results were obtained. Instead of being suspended, the pots were placed in forks between two branches, firmly lashed to one of them, thus preventing spilling of the liquid. An increase of the amount of arsenic to 3 or 4 per cent. was found beneficial. This first trial reduced the number of infested olives by 25 to 30 per cent. The pots were baited in the second half of May 1914 and an estimated total of 500,000 vine moths, *Clysia ambiguella* and *Polychrosis botrana*, were found in them, as well as many *Cetonia* beetles. The number of infested grapes in vineyards near the experimental olive area was reduced by 30 to 40 per cent., and the destruction of the beetles promised well for the fruit crop. No olive flies were found in the pots, as they fly away after feeding on the bait, and for the same reason the absence of bees and wasps was no proof that none were killed. It appeared certain, however, that birds do not drink the liquid, as in many cases there were nests in the trees where pots were placed, in which young were reared.

DEL GUERCIO (G.). **Afidi raccolti nella Somalia Italiana meridionale.** [Aphids Collected in Southern Italian Somaliland.]—Separate, dated 28th February 1916, from *Redia, Florence,* xi, no. 1, pp. 299-303, 3 figs.

It is believed that there have been hitherto no records of Somaliland Aphids. Three new species from that country are described in this paper, viz.:—*Aphis calotropidis* and *A. paoli* on *Calotropis procera,* and *A. foveolata* on *Pergularia extensa.*

BERLESE (A.) & PAOLI (G.). **Un endofago esotico efficace contro il** ***Chrysomphalus dictyospermi,*** **Morg.** [An introduced endophagous parasite of *C. dictyospermi,* Morg.]—Separate, dated 24th February 1916, from *Redia, Florence,* xi, no. 1, pp. 305-307, 2 figs.

For some years the Royal Entomological Station at Florence has been searching for a natural means of control against *Chrysomphalus dictyospermi,* Morg., and a description is given here of *Prospaltella lounsburyi,* Berl. and Paol., an endophagous Chalcid, which is a native of Madeira, sent by Prof. C. P. Lounsbury. Owing to its small size, this Chalcid attacks the female nymphs of *C. dictyospermi* as well as the adults. The percentage of parasitised females varies from 40 per cent. in the case of adults to 60 per cent. in that of the nymphs.

DAWE (M. T.). **Insectos nocivos de Colombia.** [Injurious insects of Colombia.]—*Revista Agricola, Bogotá,* i, no. 10, October 1915, pp. 585-587. [Received 7th March 1916.]

This paper refers to the need for studying the injurious insects in Colombia and gives instructions for killing, preserving and packing them when collected.

Der Einfluss des guten Wetters zur Blütezeit auf den Heuwurm und Sauerwurm. [The influence of good weather at flowering time on the two generations of *Clysia ambiguella.*]—*Schweiz. Zeitschr. Obst.- u. Weinbau, Frauenfeld,* xxv, no. 5, 8th March 1916, pp. 85-86.

It has been an old belief of vine-growers that fine weather at flowering time was the best control for both generations of *Clysia ambiguella.* This belief was exploded in 1915, when the weather in the Palatinate was very fine at flowering time and yet serious damage was caused by this pest, which extended its injury to parts of the vines not usually attacked, such as the stems, probably on account of the dry weather.

KIRSCHMER (H.). **Schutzschirm für Klebringe.** [A protective shade for sticky bands.]—*Deutsche Landwirtschaftl. Presse, Berlin,* xliii, no. 3, 8th January 1916, pp. 20-21.

The adhesives used for banding trees against *Cheimatobia brumata,* L., are very apt to harden through exposure to frost and rain, and thus become useless. Their utility may be greatly prolonged by protecting them with a metal shade, similar in shape to a lamp-shade and placed like a collar round the trunk just above the banding. These metal shades last for years and a size suitable for young fruit trees only costs about 2*d.*

Смѣты Министерства Земледѣлія на 1916 годъ. [Estimates of the Ministry of Agriculture for 1916.]—**« Извѣстія Министерства Земледѣлія.»** [*Bulletins of the Ministry of Agriculture*], *Petrograd*, nos. 38 & 41–47, 3rd October, 24th October—5th December 1915, pp. 940–944, 1000–1004, 1034–1039, 1057–1061, 1078–1079, 1100–1103, 1134–1138 & 1152.

The various scientific agricultural organisations in Russia have increased from 78 in 1907 to 238 in 1914, and the number of agricultural courses held and lectures given from 59 and 3,750 in 1908 to 1,657 and 43,763 in 1914. The current estimates include an assignment of about £640,000 for agricultural education and about £415,000 for the maintenance of various agricultural scientific and research organisations, one-half of this sum being grants in aid of the cost borne by local authorities. The control of pests is responsible for an estimate of about £10,400, in aid of the work done by local authorities, while the maintenance of the Scientific Committee of the Ministry will cost about £35,600.

Schreiber (A. F.). **О средствахъ для отпугиванія насѣкомыхъ.** [Deterrents to insects.]—**« Садоводъ.»** [*Horticulturist*], *Rostov-on-Don*, xv, no. 1, January 1916, pp. 50–51. [Received 1st March 1916.]

The author refers to the remedy against house-moths suggested by N. Ossipov [see this *Review*, Ser. A, iv, p. 60] and gives instances showing that some insects are deterred by certain odours. Thus, *Pieris brassicae*, L., never oviposits on cabbages surrounded by tomatoes, and *Pristiphora pallipes*, Lep., never oviposits on the leaves of black currants. The flowers of *Lonicera* (honeysuckle) are never visited by butterflies, though they are attractive to moths. The flowers of service trees, *Sambucus* and *Spiraea* are never visited by Lepidoptera, but are frequented by Coleoptera. He considers that these facts indicate that the question is of importance and that further research in this direction is necessary.

Отчетъ о курсахъ для подготовки техническаго персонала по борьбѣ съ саранчевыми и грызунами. [Report on preparatory courses for the technical staff for the control of locusts and rodents.] — **« Извѣстія Московскаго Энтомологическаго Общества.»** [*Bulletins of the Moscow Entomological Society*], *Moscow*, i, 28th November 1915, pp. xxxvii–xli. [Received 2nd March 1916.]

The necessity of courses for the preparation of a skilled staff for the control of insects generally and locusts in particular was urged at a Conference of Entomologists in Charkov in 1914 [see this *Review*, Ser. A, iii, p. 67]. The organisation of these courses was undertaken by the Moscow Society. They were held during March 1915, the total number of students being about 150; the cost amounted to about £90, the accommodation for the courses and the necessary equipment and materials being provided free by the Moscow Agricultural Institute.

Kulagin (N. M.). **Предстоящая работа Московскаго Энтомологическаго Общества.** [The future work of the Moscow Entomological Society.]—**«Извѣстія Московскаго Энтомологическаго Общества.»** [*Bulletins of the Moscow Entomological Society*], *Moscow*, i, 28th November 1915, pp. 1–8. [Received 2nd March 1916.]

This address, delivered at the inaugural meeting of the Society on the 14th March 1914, deals with its aims and objects. Some figures are given illustrating the great importance of insects to man and agriculture. In 1899 over 70,000 acres of sugar-beet were destroyed in the government of Kiev by *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., resulting in a loss of over 400,000 tons of sugar, while in 1900 the Zemstvo of Cherson had to pay over £33,000 for the collection of some 145,000 bushels of *Anisoplia*.

Puhov (B. A.). **Противосаранчевыя работы въ Челябинскомъ уѣздѣ въ 1914 году.** [The campaign against locusts in the district of Tcheliabinsk (govt. of Orenburg) in 1914.]—**«Извѣстія Московскаго Энтомологическаго Общества.»** [*Bulletins of the Moscow Entomological Society*], *Moscow*, i, 28th November 1915, pp. 67–90. [Received 2nd March 1916.]

In 1914 the Zemstvo of the government of Orenburg, estimating that some 19,000 acres were infested with the egg-clusters of locusts, voted about £2,000 for the campaign against them, of which about £900 was assigned to investigations in spring and autumn as to the deposition of egg-clusters. The author was in charge of the campaign, which was confined to an area of some 8,000 acres. During the preliminary investigations it was found that only a small percentage of the egg-clusters were infested with parasites. Spraying was carried out with Paris green (3 to 4 lb. in about 70 gallons of water, according to the age of the locusts), oxide of zinc (1½–2 lb. in 70 gallons of water) and sodium arsenite (1½–2 lb. in 70 gallons of water). The total cost amounted to over £1,650. The principal species present were *Gomphocerus sibiricus* and *Arcyptera flavicosta*. Owing to the lack of knowledge of the life-history of these species, the best method of conducting the campaign against them is still a matter for investigation; in this connection it is pointed out that these species do not live in dense swarms, as is the case with locusts found in Northern Caucasia. Experiments conducted with poisoned baits showed that the best consists of a paste prepared from 20 lb. of bran, 10 lb. of molasses, 1 lb. of arsenic and about 2 gallons of water; this mixture can be strewn about in fine particles.

Mizerova (F.). **Отчетъ о дѣятельности Орловскаго Энтомологическаго Бюро и обзоръ вредителей въ губерніи за 1913 годъ.** [Report on the work of the Orel Entomological Bureau and a review of the pests observed in the govt. of Orel in 1913.]—Published by the Zemstvo of the govt. of Orel, *Orel*, 1915, 31 pp.—*Ibid.* for 1914, *Orel* 1915, 23 pp. [Received 6th March 1916.]

These reports cover the first two years of the existence of the Bureau and are chiefly devoted to the insect pests occurring in the government.

These included :—Pests of cereal, clover, etc. : *Hylemyia coarctata*, Fall; *Oscinella frit*, L.; *Mayetiola* (*Cecidomyia*) *destructor*, Say; *Chlorops taeniopus*, Meig.; *Prolasioptera* (*Lasioptera*) *cerealis*, Lind.; *Ochsenheimeria taurella*, Schiff.; *Trachea* (*Hadena*) *basilinea*, F.; *Euxoa segetum*, Schiff.; *Hydroecia nictitans*, Bkh.; *Cephus pygmaeus*, L.; *Agriotes lineatus*, L.; *Apion* sp.; *Coeliodes fuliginosus*, Marsh.; *Sitones lineatus*, L.; *Psylliodes attenuatus*, Koch; *Eurygaster maura*, F.; *Anisoplia crucifera*, Hbst.; *A. segetum*, Hbst.; *Phlyctaenodes* (*Botys*) *sticticalis*, L., and *Locusta* (*Pachytylus*) *migratoria*, L.

Pests of orchards: *Euproctis chrysorrhaea*, L.; *Hyponomeuta malinellus*, Zell.; *Anthonomus pomorum*, L.; *Psylla mali*, Först.; *Aporia crataegi*, L.; *Lasiocampa neustria*, L.; *Episema* (*Diloba*) *coeruleocephala*, L.; *Cheimatobia brumata*, L.; *Rhynchites auratus*, Scop.; *Byturus tomentosus*, F., and *Aphis pomi*, De Geer. Pests of forests :—*Hylotoma pullata*, Zadd., especially on birch; *Stenolechia gemmella*, L.; *Chermes abietis*, Kalt., on silver firs; and *Coleophora laricella*, Hb.

Pests of market-gardens :—*Halticus saltator*, Geoff. [*sic*]; *Chortophila brassicae*, Bch.; *Phyllotreta nemorum*, L.; *Barathra* (*Mamestra*) *brassicae*, L.; *Pieris brassicae*, L., and *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.).

Three generations of *Oscinella frit* occurred, viz. :—in the middle of May, at the end of June and in the middle of August. Barley showed the greatest percentage of infestation, the figure being frequently 81–82 per cent., while that for wheat was about 14 per cent. and for rye 2 per cent. Early sown crops were more infested than late ones; nevertheless some authors recommend early sowing in order that the plants may become strong enough to be able to withstand attack. A large outbreak of *Hylemyia coarctata*, Fall., occurred in 1913; the larvae are injurious early in spring, when they occur inside the stem. At the beginning of May, they pass into the soil to a depth of 1–3 inches where they pupate, the adults emerging early in June. The percentage of injured stems varied from 12 to 44 in the case of winter wheat and from 13½ to 30 in the case of winter rye. *Prolasioptera cerealis* did considerable injury in one district, the damage taking the form of withered ears and broken stems. Little is known of the life-history of this fly, but it is thought that there is only one generation and that it winters in the larval stage; it is therefore recommended that infested crops should be cut as high as possible, so as to leave the larvae in the stubble, which should be immediately burnt.

Agriotes lineatus (*segetis*) is a very serious pest and was specially studied in 1914. A table is given showing the occurrence of the various stages of this beetle during the year, from which it appears that from January to April only hibernating larvae and adults are present. Experiments made with control methods showed that the use of potato baits, on which the larvae gathered and could be periodically destroyed, was the most satisfactory, both in reducing the number of the larvae and in only requiring renewal about once in four months. Injection into the soil of carbon bisulphide with kerosene in equal proportion produced a death-rate of 30 per cent., while balls of cotton waste soaked in the same mixture and placed in the soil resulted in a death-rate of only 3–6 per cent. Poisoned baits consisting of potatoes, maize, paste, etc.,

were unsatisfactory, as they were avoided by the larvae. An experiment in the laboratory, which could not be repeated on a large scale in the field, consisted of sowing wheat with Chilian saltpetre; this gave a death-rate of 100 per cent. after 10 days. The caterpillars of *Ochsenheimeria taurella*, Schiff., hibernate in the stems of winter rye and wheat, devouring the tender part of the stem above the upper node. Trap sowings are considered the best method of controlling this moth and should be carried out about two weeks before the sowing of winter crops.

Besides dealing with other pests, this report also contains details as to the general work of the Bureau, for the maintenance of which £150 was assigned by the Department of Agriculture and £130 by the Zemstvo of Orel.

DANILTCHENKO (J. M.). **Хризантемы и ихъ культура.** [Chrysanthemums and their cultivation.]—**«Садовая Библіотека.»** [*Garden Library.*]—Supplement to **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, 1916, 31 pp., 8 figs.

A table is given showing the principal pests attacking chrysanthemums and the nature of the injury in each case. The collar is injured by a fly, *Mysospatha* (*Cecidomyia*) *hypogaea*, which gives rise to galls on it, and the roots by a Nematode, *Heterodera radicicola*; the disinfection of the soil with carbon bisulphide or tobacco extract, or by powdering with flowers of sulphur, is recommended against both these pests. The leaves are mined by the larvae of another fly, *Phytomyza geniculata*, control consisting in removing the diseased leaves and in introducing carbon bisulphide into the compost. Against *Aphis rumicis* (*papaveris*), the larvae of the bug, *Calocoris chenopodii*, the caterpillars of *Cydia* (*Grapholitha*) *minutana* and other pests attacking the buds and flowers, spraying with tobacco extract and soap, and powdering with tobacco dust and flowers of sulphur when the dew is on the leaves in the morning, or fumigation with tobacco, are advised. The stems are injured by a froghopper, *Aphrophora spumaria*, which should be removed by hand, and by *Forficula auricularia*, which can be trapped in heaps of straw or leaves covered with a flower pot. [See also this *Review*, Ser. A, iii, p. 746.]

A. B. **Озимый червь.** [The "winter-crop worm" (caterpillars of *Euxoa segetum*, Schiff).]—**«Извѣстія Московской Губернской Земской Управы.»** [*Bulletins of the Uprava of the Zemstvo of the govt. of Moscow*], *Moscow*, no. 7, July 1915, pp. 38–40. [Received 13th March 1916.]

In the autumn of 1914, caterpillars of *Euxoa segetum* destroyed in three days nearly half of the winter-crops belonging to one village and were also troublesome in several other districts. To provide against a probable new outbreak of this pest in the same localities, attention should be directed to the weeds in fallow fields, where the caterpillars usually occur. If these appear to have been attacked, such fields should be separated from the neighbouring cultivated ones by trenches and must not be resown until the insects have been destroyed by means of baits.

Lutchnik (V. N.). **Къ вопросу о пищѣ личинокъ комаровъ долгоножекъ.** [On the question of the food of larvae of Tipulidae.]—**«Хозяйство.»** [*Husbandry*], *Kiev*, xi, no. 5–6, 25th February 1916, pp 88–89.

Various Tipulids of the genera *Tipula* and *Pachyrhina* are found in abundance in the governments of Volhynia, Minsk and Mohilev. The larvae were found experimentally to prefer salad and cabbage to the roots of grasses. Some of them proved to be infested with Tachinid parasites, and they are also destroyed by birds and some predaceous beetles. They can be collected early in the morning, when they emerge on the surface of the soil, and their destruction may be assisted by utilising poultry. These larvae are not considered to be so seriously injurious to grain crops as in market-gardens. Rolling the soil is not regarded as an effective method of control.

Karny (H.). **Beitrag zur Kenntniss der Russischen** *Haplothrips*-**Arten, (съ переводомъ Н. В. Курдюмова).** [Contribution towards the study of the Russian species of *Haplothrips*, (with a Russian translation by N. V. Kurdjumov).]—**«Труды Полтавской Сельско-Хозяйственной Опытной Станціи, No. 18. Отдѣлъ сельско-хозяйственной энтомологіи. Выпускъ VII.»** [*Trans. Poltava Agric. Exp. St.*, no. 18, *Dep. of Econ. Entom.*, no. 7.], *Poltava*, 1913, pp. 1–18. [Received 15th March 1916.]

A collection of species of *Haplothrips* from the Poltava Station having been sent to the author at Vienna by N. V. Kurdjumov, a description is here given of the morphology of the species of this very variable genus. The genus *Haplothrips*, Serv. (*Anthothrips*, Uzel) is undoubtedly the most complicated of the Thysanoptera and a critical comparison of the Russian species is destined to serve as a basis for the pending revision of the whole genus. The species dealt with include: *Haplothrips statices*, Hal.; *H. tritici*, Kurdj.; *H. aculeatus*, F.; *H. kurdjumovi*, which is regarded as a variety of the previous one, having been found by Kurdjumov inside galls of *Aphis crataegi* and breeding also on eggs of *Sciaphobus squalidus*; this species also resembles in some respects *H. japonicus* and *H. oryzae*, and *H. cahirensis*; *H. heymonsi*, sp. nov., obtained from Turkestan, Syr-Daria, Transcaucasia and Tiflis, and allied to *H. kilmandjaricus* and *H. usitatus* on one side, and *H. oryzae* and *H. japonicus* on the other.

Kurdjumov (N. V.). **Дополнительныя замѣтки по біологіи пустоцвѣтнаго и пшеничнаго трипсовъ.** [Additional notes on the biology of *Haplothrips aculeatus*, F. and *Haplothrips tritici*, Kurdjumov.]—**«Труды Полтавской Сельско-Хозяйственной Опытной Станціи. No. 18. Отдѣлъ сельско-хозяйственной энтомологіи. Выпускъ VII.»** [*Trans. Poltava Agric. Exp. St.*, no. 18, *Dep. of Econ. Entom.*, no. 7], *Poltava*, 1913, pp. 19–32. [Received 15th March 1916.]

Two generations of *Haplothrips aculeatus* were observed in 1912, the food-plants being rye, maize, Italian millet and oats. Cases of cannibalism amongst the larvae were observed, as well as a case in

which one of them attacked a dying larva of a species of *Triphleps*, but it is thought that this species is usually phytophagous, consuming animal food only in cases of necessity. The enemies of this thrips include *Triphleps niger* and the larvae of *Aeolothrips fasciatus*, Hal. There was only one generation of *Haplothrips tritici*, Kurdj., in 1912. Oviposition occurs on the ears of both summer and winter sown wheat; the larvae were also found on oats, but not on barley; in two cases heads of clover were found containing a great number of these larvae. The development of the nymphs takes place at temperatures not lower than 45–50° F., and not higher than 85° F. The larvae suffered from a fungus disease caused by *Botrytis bassiana*, Bals., high temperature and increased moisture being necessary for the development of the fungus. The chief enemy of this species is *Aeolothrips fasciatus*, which, according to Uzel, winters in the larval or egg stage. Both adults and larvae of this predaceous thrips are found on various plants, and the larvae have been found feeding on *Aphis crataegi* and *A. rumicis* (*euonymi*), on Cecidomyid larvae, on eggs of *Sciaphobus squalidus*, on larvae of *Anthonomus pomorum*, on larvae and nymphs of *Limothrips denticornis*, Hal., on eggs of *Cicadula sexnotata*, Fall., and *Deltocephalus striatus*, L., etc. In one case they were found inside a cocoon of a species of *Cionus* sucking an egg of *Habrocytus cioni*, Thoms., which was deposited on the pupa of the beetle. The larvae are also cannibals and their presence inside flowers of *Linaria vulgaris* (toad flax) tends to show that they are omnivorous. The larvae of *A. fasciatus* were observed to weave cocoons, which has not previously been recorded in the case of thrips, inside which they pass the stages of pronymph and nymph. The duration of the pronymphal and nymphal stages are equal, a fact which distinguishes these insects from other Thysanoptera. A key is given to the nymphal stages of this order, based on certain peculiarities in their structure. Two generations of *A. fasciatus* occurred, and it is thought that they only winter as larvae, presumably after having prepared a cocoon.

TRUBATCHEV (V. I.). **Примѣненіе лизоля въ садахъ.** [The use of Lysol in orchards.]—**« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, xiii, no. 6, 20th February 1916, pp. 182.

Lysol has been used with great success in the orchards in charge of the author in Turkestan. A 4 per cent. solution is used in autumn after the leaves have dropped and again in spring. A 2 per cent. solution is effective against the curling of the leaves of pear trees, against *Cydia pomonella*, and against Aphids. The spraying operations against *Cydia* are started after the blossoming and repeated every 20–25 days up to the end of August. In order to make the solution adherent, molasses may be added (½ lb. of black or ¼ lb. of white to each 3 gallons of the solution). Lysol is also useful when the soil is rammed hard round the roots so that a space is formed by the movements of the tree in the wind, down which the insecticide may be poured.

BALABANOV (M.). **Борьба съ букаркой или листовымъ слоникомъ.** [The control of *Rhynchites pauxillus*.]—**Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, xiii, no. 8, 5th March 1916, pp. 245–246.

The author is of opinion that *Rhynchites pauxillus* hibernates partly in the soil and partly in cracks of the bark of trees and that the weevils are able to fly early in spring, particularly in warm, fine weather. This view is at variance with that of some other authors, who believe that the insects do not fly at that season, but, having emerged from the earth, creep on to the trees. If Balabanov's opinion be correct, it would render the application of tanglefoot more or less useless.

It is also pointed out that if the sticky belts are put on before spraying with milk of lime, the effect of the latter is to cover the surface of the adhesive with a thin layer of lime, over which the insects are able to pass unharmed.

VASSILIEV (Eug. M.). **Посѣщается ли аконитъ насѣкомыми?** [Do insects visit Aconite plants?]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, xiii, no. 8, 5th March 1916, pp. 247–248.

The author disputes the statement of V. Gomilevsky that aconite plants are never visited by insects [see this *Review*, Ser. A, iv, p. 58]. Various insects attack this plant, as was recorded by Kaltenbach in 1874; they include the Chrysomelids, *Crepidodera cyanescens*, Duft., and *C. alpicola*, Ulr.; *Arctia caja*, L.; the Noctuid, *Amphipyra tragopoginis*, L., the caterpillars of which devour not only leaves of aconite but also of *Delphinium*, containing an alkaloid which is deadly to caterpillars of *Euxoa*. The caterpillars of *Phytometra* (*Plusia*) *variabilis*, Piller, and *Chrysoptera* (*Plusia*) *moneta*, F., injure the leaves of aconite, which are also mined by larvae of *Phytomyza nigricornis*, Meig., and attacked by *Aphis napelli*, Schk.

SOPOTZKO (A. A.). **Вредны ли сѣменному клеверу жуки-сѣмяѣды рода Apion?** [Are weevils of the genus *Apion* injurious to seed clover?]—**«Хозяйство.»** [*Husbandry*], *Kiev*, xi, nos. 1–2 & 7–8, 28th January & 10th March 1916, pp. 15–20 & 125–137.

This paper disputes the accuracy of the work of T. Shtcherbakov on this subject [see this *Review*, Ser. A, iii, p. 641 and A, iv, p. 142]. Shtcherbakov bases his conclusions partly on examination of clover in 1914, when these weevils appeared in small numbers, as predicted by the author in his report for 1913–1914 [see this *Review*, Ser. A, iii, p. 634]. The author reiterates his statement that the larvae of *Apion* devour the ovaries, each individual being able to destroy 7–9 ovaries, besides gnawing a burrow in the base of the inflorescence before pupating, causing all the flowers situated above this point to wither. A number of statistics are given to support these statements.

NIKITIN (V.). **Опыты съ минеральными удобреніями на огородѣ.** [Experiments with mineral manures in market-gardens.]—**«Садъ и Огородъ.»** [*Orchard and Market-Garden*], *Moscow*, xxxi, nos. 7, 8, 9, 10, 11 & 12, July, August, September, October, November & December 1915, pp. 290–299, 335–349, 393–403, 425–433, 452–462 & 489–495.

Among the pests of cabbages studied at the Agricultural Institute of Moscow, during 1914, were:—*Chortophila* (*Anthomyia*) *brassicae*, Bch., the larvae of which infested the stalks of seedlings; washing the roots in cold water before planting was fairly effective. Other pests were *Pieris rapae*, L., *P. brassicae*, L., *Aphis brassicae*, L., against which spraying with soft soap was applied, *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) and *Mamestra brassicae*, L., the last-named proving the most serious. Its control consisted of hand-picking and destroying the caterpillars.

GOLITZIN (S.). **Опытъ борьбы съ медяницей окуриваніемъ сада.** [An experiment on the control of *Psylla* by means of fumigation.] —**«Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxvii, no. 2, February 1916, pp. 73–75.

An experiment on controlling *Psylla* by means of fumigation in an orchard of 24 acres in the government of Riazan is described. During 1914 and the spring of 1915, various spraying operations with kerosene emulsion and copper sulphate with Paris green or lime were tried without success. The results of fumigation with tobacco dust were however highly successful and less expensive than spraying.

OSSIPOV (A.). **Результаты опытовъ.** [Results of experiments.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 2, February 1916, pp. 70–75.

The experiments described in this article were conducted at the Bessarabian Entomological Station. Urania green was tested on caterpillars of *Papilio podalirius*, L., by feeding them on branches of plum sprayed with the insecticide. A dose of about 1½ oz. in 27 gallons of water resulted in a death-rate of 6 per cent. during three days and of 26 per cent. during the next two days; a stronger dose of 3 oz. in 27 gallons of water gave a death-rate of 26 per cent. and 40 per cent., while the figures for a strength of about 4 oz. in 27 gallons of water were 36 per cent. and 60 per cent.; thus the first strength gave a total death-rate in five days of 34 per cent., the second 66 per cent., and the third 96 per cent. Quicker results may be expected if stronger solutions are used, while an additional advantage of Urania green is the fact that it requires no lime.

London purple was tested on caterpillars of *Vannesa io*, L., nettles sprayed with the insecticide being used; a dose of 45 oz. of purple, and double that quantity of slaked lime in 27 gallons of water gave rise to 10 per cent. of dead caterpillars after the first and another 64 per cent. after the second day, the remainder perishing in the course of the third, fourth and fifth days. The same insecticide at double the above strength destroyed 100 per cent. in one day. No injury to the

plants was observed from this substance, either in the laboratory or in the open, when it was used as a 6 per cent. solution for the control of caterpillars of *Cheimatobia brumata* in one orchard in April. Owing to the small size of the caterpillars at that period, they perished in a few hours after the spraying, whereas experiments in the laboratory on adult caterpillars caused death only after 24 hours. Purple was also used with success for the control of *Phlyctaenodes sticticalis*. Experiments have shown that some plants can stand even a stronger solution without showing signs of scorching; pear-leaves showed no scorching even from a solution containing 52 oz. of purple in 27 gallons of water; plum trees were slightly affected by a solution of this strength, while almonds suffered even from a solution of 30 oz. in 27 gallons of water.

PLIGINSKY (V. G.). **Опытъ учета результатовъ окуриванія медяницы.** [An experiment on estimating the results of fumigation against *Psylla mali*, Schm.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, **xv**, no. 2, February 1916, pp. 101–103.

Doubts have been expressed by some authors whether fumigation with tobacco smoke, really destroys all the *Psylla* present, or whether some individuals are only temporarily stupefied. The author describes experiments in estimating the actual effect of this method, in which sheets were placed underneath the trees and everything found on them after fumigation was collected into boxes and examined. It was found that *Psylla mali* is totally destroyed by this means and of over 8,000 examples only about a dozen showed any signs of life. On the following day no *Psylla* were to be seen in this orchard, except a few individuals on trees adjoining neighbouring orchards, where no fumigation had been carried out. The fumigation does not however affect many of the parasites. This method of control is considered the cheapest and most effective, if properly applied, but it ought to be carried out simultaneously in all adjoining orchards.

EMELIANOV (I. A.). **Техника постановки опытовъ по с.-х. энтомологіи. I. Термостаты и гигростаты.** [The Technique of Experiments in Economic Entomology. I. Thermostats and Hygrostats.]—Published by the Entomological Department of the Charkov Agricultural Experimental Station, no. 1, *Charkov*, 1915, 53 pp., 22 figs. [Received 22nd March 1916.]

In this paper the author describes and figures in detail various forms f apparatus for controlling temperature and moisture, used in research rork in Economic Entomology.

The incubators described include those (1) for a temperature lower han 0° C., which are necessary when studying the conditions of ibernation of insects, the influence on them of sudden changes in emperature, etc. Of this type of apparatus, those dealt with include he one used at the Tennessee Experimental Station (described by . C. Cotton in a paper read at the 22nd Annual Congress of American ntomologists) which gives very low and constant temperatures, but expensive, and the apparatus of S. Hunter; neither of these is entilated and there is no means of regulating the moisture.

(2) For temperatures higher than 0° C. up to the temperature of the surrounding air, the apparatus of Headlee and the polythermostat of the Poltava Experimental Station, constructed by N. V. Kurdjumov at a cost of only £8, are described.

(3) For temperatures higher than the surrounding air, the most remarkable apparatus is that of Tower, which cost the enormous sum of £25,000 and permits the climate of Mexico to be reproduced in Chicago. Other apparatus of this type are the soil thermostat of Tower; the apparatus of the Tula Entomological Station, suitable for work not requiring great precision and costing about £5; the thermostat of Schribaux-Roux and that of the Charkov Experimental Agricultural Station (of the Entomological Department of which the author is the Director).

The hygrostats described are: the soil box of Graf, the thermo-hygrostat of Headlee and that of Tower. An account is given of the methods in use at the Stations of Tula and Charkov.

KITCHUNOV (N.). **Пеканъ и его культура.** [Pecan-nut trees and their cultivation.]—« Садъ и Огородъ.» [*Orchard and Market-Garden*], *Moscow*, xxxi, nos. 7, 9, 10 & 11. July, September, October & November 1915, pp. 283–290, 383–392, 421–425 and 448–452. [Received 30th March 1916.]

The author discusses the possibility of the cultivation of the pecan nut in Southern Russia and gives full details on this point from American sources for the benefit of Russian agriculturists. In America the leaves of this tree are attacked by the caterpillars of *Hyphantria cunea*, *Proteopteryx deludana*, *Acrobasis nebulella*, *Catocala piatrix*, *Catabapta viduata* and *Datana integerrima*. Control measures consist of spraying with Paris green or other arsenious substances. The Longicorns, *Oncideres cingulatus* and *O. texana*, injure the twigs and branches, which are also injured by larvae of *Elaphidion villosum*, and the caterpillars of *Aegeria* (*Sesia*) *scitula*; the latter may be destroyed by introducing a hot wire into their burrows. The nuts are damaged by *Balaninus caryae*, and may be fumigated with carbon bisulphide.

URICH (F. W.). **Notes on the South American locusts:** *Schistocerca paranensis*, **Burm.**—*Bull. Dept. Agric. Trinidad & Tobago*, *Port-of-Spain*, xv, no. 1, 1916, pp. 15–16.

Though Trinidad proper was not invaded by any swarms of *Schistocerca paranensis* from Venezuela [see this *Review*, Ser. A, iv, p. 92], a small one alighted on the island of Patos on 3rd November. Poisoned bran mash was scattered at the rate of 8 lb. per acre and after three days there were hardly any locusts left. An unexpected result was the poisoning of numerous rats which infest the island. In another paper on rat poisoning, the composition of the bait is stated to be: Paris green or white arsenic, 2½ lb.; bran (or coconut meal), 50 lb.; molasses, 4 quarts, and water, 5 gallons.

The poison and the bran are mixed dry and then the well-mixed molasses and water is added. Sufficient water is again added to make a wet mash. The bait must be made up on the day of using. About

5 per cent. of the coconut palms were totally stripped and about 10 per cent. partly so. All sucrier bananas were completely destroyed, but silk bananas only slightly. Cassava, maize and sugar-cane were eaten to the ground. Cacao trees were not touched. So far as can be judged, the danger of an invasion of Trinidad is over until February.

URICH (F. W.). **Insects affecting the cotton plant in Trinidad.**—*Bull. Dept. Agric. Trinidad & Tobago, Port-of-Spain*, xv, no. 1, 1916, pp. 18–19.

The worst pests of cotton in Trinidad are the cotton-stainers, *Dysdercus howardi*, Ballou, and *D. howardi* var. *minor*, Ballou. They are occasionally parasitised by a Tachinid, a species of *Trichopoda*. Hand-picking, trapping and the destruction of food-plants growing wild, viz., *Malachra capitata, Sida glomerata, Eriodendron anfractuosum* (silk cotton), are the controls advised. A Coreid bug, *Hypselonotus fulvus*, De Geer, is not a pest, but comes to cotton during the flowering period. It is mostly found on *Malachra capitata*. Another Coreid, *Sphictyrtus intermedius*, Stål, is found on cotton about the flowering period, but occurs also on *Cordia cylindrostachya* (black sage). The Pyrrhocorid, *Largus lunatus*, F., is not a pest of cotton; it also occurs on *Sida glomerata*. The Pentatomid, *Sphyrocoris obliquus*, Germ., is found in the young and adult stages in old cotton bolls left over in the field, but does not seem to attack fresh tissues. Its eggs are parasitised by a Proctotrupid, *Trissolcus trinidadensis*, Cwfd. *Alabama argillacea* (cotton worm) is usually kept in check by natural enemies such as *Polistes canadensis* (Jack Spaniard), a Tachinid, *Phorocera* sp., etc., but after exceptionally dry seasons there are large outbreaks, when dusting or spraying with arsenicals should be resorted to. The cotton aphis, *Aphis* sp., is preyed upon by larvae of Syrphid flies and the Coccinellids, *Megista maculata*, de G., *Cycloneda sanguinea*, L., and *Scymnus auritulus*, Muls. *Hemichionaspis minor*, Mask. (snowy scale) and *Saissetia nigra*, Nietn. (black scale) are not serious pests. The former is parasitised by the Chalcid, *Aspidiotiphagus citrinus*, while the latter is preyed upon by the Coccinellid, *Azya orbigera*, Muls., and is also destroyed by the Encyrtid parasite, *Lecaniobius cockerelli*, Ashm.

THEOBALD (F. V.). **Notes on Aphididae found in Ants' Nests.**—*Entomologist, London*, xlix, no. 634, March 1916, pp. 49–52, 2 figs.

The collection of Aphids, here recorded, was obtained from ants nests near Porlock, Somerset and includes:—*Macrosiphum myrmecophilum*, sp. n.; *Hyalopteroides pallida*, gen. et sp. n.; *Tycheoides eragrostidis*, Pass.; *T. setulosa*, Pass.; *T. setariae*, Pass.; *Trama troglodytes*, Heyd.; *T. radicis*, Kalt.; *Forda formicaria*, Heyd.; *F. viridana*, Buck.; *Tetraneura ulmi*, L.; *Aphis plantaginis*, Schr.; and *Geoica carnosa*, Buck.

FULLER (C.). **Observations on some South African Termites.**—*Ann. Natal Museum, London*, iii, no. 2, October 1915, pp. 329–504, 16 figs., 11 plates. [Received 4th March 1916.]

Most South African termites are subterranean in habit and are probably abundant in the soil in many parts of the country. In the

south-west of Cape Province, where attacks on wooden structures are almost unknown, *Hodotermes viator* is common; in the Great Karroo, *H. karrooensis* is ubiquitous, and in restricted areas *Eutermes trinervius* abounds. The last-named species is found also in great numbers in the Orange Free State.

The pairing habits of the following species are described:—*Hodotermes transvaalensis*, sp. n.; *Termes natalensis*, Hav.; *T. latericius*, Hav.; *T. vulgaris*, Hav.; *T. incertus*, Hag.; *Eutermes bilobatus*, Hav. Observations on the nesting habits and general economy of certain species are recorded. In the case of *H. transvaalensis* cavities are made near the surface of the soil for the storage of harvested material. Harvesting is carried on during the daytime and the insects are especially active during autumn and early winter. In Pretoria, however, grass for storage is collected all through the summer. *Calotermes durbanensis*, Hav., occurs commonly along the coast of Natal. According to Haviland, this species burrows into living wood, the invaded part decaying later; orange trees are also attacked. Mound-forming species described are *Termes waterbergi*, sp. n., *T. natalensis*, Hav., *T. latericius*, Hav., *T. vulgaris*, Hav., *Eutermes trinervius*, Rambur, etc. A classification and systematic account of the South African species concludes the paper.

JOHNSON (P. M.) & BALLINGER (A. M.). **Life-History Studies of the Colorado Potato Beetle.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 20, 14th January 1916, pp. 917–926, 1 plate, 10 tables. [Received 8th March 1916.]

Experiments on the life-history of *Leptinotarsa decemlineata*, Say (Colorado potato beetle) during 1914 were conducted under indoor conditions at a high temperature and more than the normal rate of humidity. Overwintering beetles emerged from hibernation under outdoor conditions on 29th April on *Solanum jasminoides*. Pairs were isolated in breeding jars and supplied with leaves of *S. jasminoides* and later with those of the potato, for which they showed a marked preference. Egg-laying began a few days after the isolation of the pairs; the number of eggs in one mass averaged from 35 to 45, while between 379 and 1,879 were deposited by a single overwintering female. Eggs deposited on 4th May hatched on 12th May; the larvae fed until 28th May, when they entered the ground to a depth of 3 inches to pupate. Adults emerged on 9th June. The overwintering beetles fed until 7th September, when the last one died. The adults of the first generation fed for a short time; some went into hibernation, but the majority deposited eggs giving rise to a second generation. Eggs laid on 30th June hatched on 7th July. The larvae pupated on 25th July and adults emerged on 31st July. Some of the adults hibernated, others gave rise to a third generation. An egg-mass deposited on 4th August hatched on 9th August, the larvae pupating on 23rd August and adults emerging on 31st August. Beetles of this generation were active during September, thus suggesting the possibility of a partial fourth generation. Mating was observed during the same month and in some instances fertilisation took place, since the females, upon emergence from hibernation in the next spring, were able to oviposit without pairing a second time.

Herrick (G. W.) & Matheson (R.). Observations on the Life-History of the Cherry Leaf Beetle.—*Jl. Agric. Research, Washington, D.C.*, v. no. 20, 14th February 1916, pp. 943–950, 2 plates. [Received 8th March 1916.]

During the summer of 1915 severe outbreaks of *Galerucella cavicollis*, Lec. (cherry leaf-miner) occurred in western and south-western New York. Injury to cherry, peach and plum was reported during June and early July, but ceased entirely during the next month. The sudden appearance in harmful numbers of this insect may be attributed to conditions favourable for increase and hibernation during 1914 and the winter of 1914–15. The suggestion that the beetles migrated from Pennsylvania is probably incorrect, since the native host, *Prunus pennsylvanica*, is a northern tree, occurring southward only as far as Pennsylvania and, in the mountains, to North Carolina and Tennessee.

G. cavicollis is widely distributed, having been recorded from Canada, through the New England States southward to Pennsylvania and west to Winconsin, and from North Carolina, Texas, and British Columbia. Adults probably emerge from hibernation during the last half of April or May. Feeding continues actively during May and June, the food consisting of the leaves of pin-cherry, cherry, peach and plum. Early in July the beetles begin to leave cultivated food-plants. At Ithaca, egg-laying takes place from June to August, the eggs being deposited in masses at the base of the pin-cherry. In the latter part of July eggs hatch out in from 14 to 18 days. The larvae climb up the trunks of the host tree and feed on the young foliage; when they are abundant, the leaves become completely skeletonised and die. Experiments have shown that they are unable to survive on *Prunus avium* (cultivated sweet cherry), or the native species, *P. serotina* and *P. virginiana*. Maturity is reached in two or three weeks, when the larva pupates at or slightly below the surface of the soil. The length of the pupal stage is about 18 days. In New York there is a single brood during the season. Adults emerging in August feed exclusively on the pin-cherry and in the breeding cages began to enter the soil to hibernate about the middle of September.

In the control of this insect, lead arsenate spray at the rate of 4 or 5 lb. paste to 100 gals. water, or nicotine, 3 pts. to 100 gals., have been successfully used.

Ehrhorn (E. M.). Report of the Division of Entomology.—*Hawaiian Forester and Agriculturist, Honolulu,* xiii, no. 2, February 1916, pp. 43–45.

During November 1915 the following pests were intercepted:—*Phenacaspis eugeniae* on ornamental plants; from Holland, *Prenolepis longicornis* on bulbs; from New Jersey, *Diaspis boisduvali* and *Aspidiotus cyanophylli* on orchids; from Japan, *Bruchus chinensis* in peas; from Singapore, *Prenolepis* sp., *Monomorium* sp., Elaterid larvae, a cockroach, *Leucophaea surinamensis*, and millipedes on wax palms and *Mussaenda erythrophyllis*, and *Pseudococcus* sp. on *M. erythrophyllis*; from Japan, *Aulacaspis pentagona* (peach scale) on peach twigs. A package of chestnuts found in the luggage of an immigrant was found to be infested with a weevil, probably *Balaninus* sp., and was destroyed.

During the month 18,064 parasites of fruit-flies were reared, and 21,730 parasites of the horn-fly, house-fly and stable-fly were liberated. The breeding of *Paraleptomastix abnormis*, a parasite of the mealy bug, was continued.

Hill (G. F.) **Report of the Government Entomologist to the Administrator of the Northern Territory of Australia for the eighteen months ended 30th June 1915.** pp. 43-46 of Administrator's Report for the year 1914-15.—[*Sine loco.*] 1915, 2 plates. [Received 9th March 1916.]

The following insect pests are noted in this report:—*Earias huegeli*, Rog. (boll worm) and *Dysdercus cingulatus*, F. (red cotton bug) on cotton; several scale-insects, including *Lepidosaphes beckii* (*Mytilaspis citricola*), *Chrysomphalus aurantii* (*Aspidiotus coccineus*), *C. aonidum* (*A. ficus*), and *Parlatoria ziziphus*, on citrus trees, *Aspidiotus destructor* and *C. aonidum* on coconut palms, and *A. orientalis* on papaws. The last-named species appears to be spreading rapidly in spite of the abundance of predaceous Coccinellids.

Experiments in the control of termites showed that arsenic in some form is the cheapest and most effective substance to use for the protection of timber.

Franklin (H. J.) & Morse (F. W.). **Report on Experimental Work in Connection with Cranberries.**—*Massachusetts Agric. Expt. Sta., Amherst.* Bull., no. 150, April 1914, pp. 37-68, 10 tables. [Received 9th March 1916.]

During 1913 there was a marked decrease in the numbers of both *Rhopobota vacciniana*, Pack. (flowed-bog fire-worm) and *Mineola vaccinii*, Riley (cranberry fruit worm), but *Epelis truncataria* var. *faxonii*, Minot (cranberry span-worm), and various species of cutworms were unusually abundant. It was noticeable that winter flooding produced very slight mortality among the pupae of this species, which has also been found feeding on the bearberry. A small Trypetid was reared from cranberries which has been identified as a small variety of the apple maggot (*Rhagoletis pomonella*, Walsh).

The following parasites were reared from cranberry pests, as well as some which appear to be new to science:—The Tachinid, *Exorista pyste*, Walk., and the Ichneumons, *Phytodietus vulgaris*, Cress., and *Pimpla conquisitor*, Say, from *Peronea minuta*, Rob.; the Braconids, *Phanerotoma tibialis*, Hal., and *Microbracon dorsator*, Say, from *Mineola vaccinii*; *Ichneumon extremitatis*, Cress., and the Tachinid, *Euphorocera claripennis*, Macq., from *Cymatophora sulphurea*, Pack.; *Winthemia quadripustulata*, F., from *Xylina* (*Calocampa*) *nupera*, Lintner; and *Tachina robusta*, Town. These parasites, and especially those of *R. vacciniana*, are very liable to destruction during the flooding of the bogs [see this *Review*, Ser. A, iii, p. 532]. *Phanerotoma tibialis* was by far the most important parasite of *M. vaccinii*. Berries from the dry bog produced three times as many parasites in proportion to fruit-worms as did the berries from the flooded bog. The time of greatest emergence of the parasites was between 30th June and 9th July. A study of the control of *M. vaccinii* in flooded bogs showed that

submergence lasting nine days, carried out after 8th October, appeared to have little effect on the larvae. It is possible that submergence earlier in the season would have given a better result. Sanding experiments in dry bogs for destroying the pupae seemed to show that this method of treatment will never be practicable. Spraying with a 20 per cent. solution of iron sulphate on dry bogs was tested. Three applications killed the blossoms without injuring the foliage or buds for the next year.

ANDREWS (E. A.). **Entomologist's tour in Cachar and the Duars.**—*Qrtly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* Part iv, 1915, pp. 113–117. [Received 10th March 1916.]

In Cachar and Sylhet *Tetranychus bioculatus* (red spider) was more in evidence in 1915 than usual. The most serious pests in the North appeared to be termites, which in many places had done a great deal of damage. Borers were frequently noticed, and the common caterpillar pests, *e.g.*, the Geometrid, *Biston suppressaria*, the Bombycid, *Andraca bipunctata, Heterusia magnifica* (red slug) and *Clania* spp. (faggot and bag worms) were all found in the district. A case is recorded where *Helopeltis theivora* migrated from tea to a mango tree, a good deal of the young foliage of which was blackened and shrivelled by the attack.

Plant Pests (Amendment) Ordinance, no. 20 of 1915.—*Uganda Official Gaz., Entebbe,* 15th December 1915, p. 506. [Received 13th March 1916.]

These amendments to the Plant Pests Ordinance of 1912 relate to the establishment and constitution of the Plant Pest Board. The powers of the members of this Board are defined.

Declaration of the Governor in Privy Council.—*Jamaica Gaz. Extraordinary,* 5th January 1916, 1 p. [Received 13th March 1916.]

Under section 3 of Law 3 of 1915 the black weevil borer of bananas [*Cosmopolites sordidus*] is declared to be an infectious plant disease within the meaning of the Act.

RITCHIE (A. H.). **The Black Beetle attacking Banana Cultivations.**—*Daily Gleaner, Kingston, Jamaica,* 22nd January 1916, p. 18, 2 figs. [Received 13th March 1916.]

The black weevil borer of bananas [*Cosmopolites sordidus*] occurs in Jamaica in certain well-defined areas. This insect is distributed over the entire Caribbean region and it is not definitely known why it is not coextensive with another well-known borer in Jamaica, namely, *Metamasius sericeus*. The larvae of *C. sordidus* tunnel into the base of the banana, in which position also pupation takes place. Injury results in the premature withering of the outer leaves, scarcity of leaves and production of undersized fruit. The author urges the necessity for co-operation in controlling this pest.

SURFACE (H. A.). **Pest Suppression.**—*Bi-Mthly. Zool. Bull., Pennsylvania Dept. Agric., Harrisburg*, v, no. 6, November 1915, pp. 99–113. [Received 13th March 1916.]

In addition to the better known insecticides, the following are recommended:—As repellants: kerosene and sand, 1 qt. to 1 peck of sand, scattered near the roots of cabbage or onion plants; tar, at the rate of one teaspoonful to 1 qt. water, poured over the seeds of cereals in the soil; turpentine mixed with lime or sand, placed round plants on the surface of the soil.

As a combined insecticide and fungicide: resin-Bordeaux mixture, at the rate of 2 U.S. gals. resin-lye mixture and 48 gals. Bordeaux mixture; Paris green or lead arsenate may be added if desired.

As adhesives: resin-lye mixture, consisting of 5 lb. resin, 1 lb. concentrated lye, 1 pt. fish oil, 5 gals. water, used at the rate of 2 or 3 gals. to a barrel (31½ U.S. gals.) of spraying liquid; resin-fish-oil soap, or whale-oil soap, 3 or 4 lb. to 50 gals. spray.

SURFACE (H. A.). **The Lime-Sulfur Solution.**—*Bi-Mthly. Zool. Bull., Pennsylvania Dept. Agric., Harrisburg*, v, no. 6, November 1915, pp. 114–129. [Received 13th March 1916.]

Lime-sulphur from the formula, quick lime 1 lb., sulphur 2 lb., water 1 (U.S.) gallon, boiled together for three-quarters of an hour, is recommended and practical information as to its preparation is given; the method of preparation of self-boiled lime-sulphur from lime 8 lb., flowers of sulphur 8 lb., water 50 (U.S.) gallons is given with a warning as to the indiscriminate use of the commercial "dry sulphur compound," which is more expensive than the home-boiled and liable to cause serious scorching. The sediment resulting from the preparation of lime-sulphur is valuable in several ways:—(1) in counteracting soil acidity and thereby improving the growth of leguminous crops; (2) as a preventive of club root and black rot of cabbage and as a tonic for orchard trees; (3) as an addition to dormant spraying fluids, rendering them more adhesive; from 2 to 5 gals. may be added to 50 gals. of spray; (4) as a wash to prevent borers of trees; from ½ to 1 pt. should be applied to each tree, and against the peach borer [*Anarsia lineatella*] three or four applications during the summer are recommended. The results of this use of the sediment are said to be highly satisfactory.

MASKEW (F.), **Quarantine Division: Rept. for the Month of December 1915.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 2, February 1916, pp 74–76.

The insect pests intercepted were:—From Mexico: *Lepidosaphes gloveri* on limes, *L. beckii* on lemons. From Central America: *Pseudococcus* sp. on crotons, a Coccid on palms, *Aspidiotus cydoniae* and *Chrysomphalus scutiformis* on bananas. From Belgium: *Aleurodes* sp. on azaleas, *Aspidiotus britannicus* and *Coccus hesperidum* on bays. From Brazil: *Cerataphis lataniae* on orchids. From China: Lepidopterous larvae in garlic. From Greece: *Saissetia oleae* and *Parlatoria*

ciliantkina on olives. From Hawaii: *Chrysomphalus aurantii* on orchids, Trypetid larvae in red peppers, *Pseudococcus bromeliae* and *Diaspis bromeliae* on pine-apples, *Coccus longulus* on betel leaves, *Hemichionaspis* sp. on air plant, *Lecanium* sp., *Pseudaonidia* sp. and *Aspidiotus* sp. on unknown plants. From Holland: *Lepidosaphes ulmi* on boxwoods. From Japan: Weevil larvae in chestnuts, *Parlatoria* sp. and *Hemichionaspis aspidistrae* on maples, *Calandra* sp. in wheat, *Aleurodes* sp. on gardenias; *Chionaspis citri*, *Aspidiotus* sp., *Chrysomphalus aurantii*, *Pseudococcus nipae*, *Parlatoria* sp., *Lepidosaphes gloveri*, *Pseudaonidia trilobitiformis*, *Cladosporium citri* and *Leptothyrium pomi* on oranges. From the Philippine Islands: *Pseudococcus* sp. on pot plants. From Samoa: *Morganella maskelli* on oranges. From Australia: *Chrysomphalus aurantii* on Kentia palm. From Tahiti: *Morganella maskelli* on limes. From Florida: *Phomopsis citri* on grape-fruit. From Nevada: *Heterodera radicicola* in potatoes. From Oregon: *Coccus hesperidum* on holly, *Aspidiotus perniciosus* on rose. From Texas: *Aleurodes* sp. on Cape jessamine. From Louisiana: *Chrysomphalus* sp. on grape-fruit.

BRITTAIN (W. H.) & GOODERHAM (C. B.). **An Insect Enemy of the Parsnip.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 2, February 1916, pp. 37–41, 1 fig., 1 plate.

Depressaria heracleana, de G. (parsnip webworm) has been recorded from Great Britain, Germany, Sweden, Finland, France, Eastern United States and Canada. In Nova Scotia, *Heracleum lanatum* (cow parsnip) is the common food-plant; *Pastinaca sativa* (cultivated parsnip) is usually attacked when grown for seed, while *Daucus carota* is also injured. In Europe, *H. spondylium* and *H. sibericum* may also serve as host plants. During 1915, serious damage was caused to parsnips grown for seed at Truro, Nova Scotia. The eggs were first observed on 18th June, and were deposited singly on leaves, stems and sheaths surrounding the flower heads. The duration of the egg-stage is about seven days. The larvae, upon hatching, bore into the young flower buds which are bound together by a silk web and form the food of the developing larva. After about four weeks, the larvae crawl down the stem as far as the axil of a leaf, at which point they bore into the hollow stem. Pupation takes place a few days later. Adults emerge during the latter half of August, and hibernate under the bark of trees or in other sheltered positions. At Truro a number of Hymenopterous parasites have been reared from *D. heracleana*. The pupae are destroyed by earwigs and by *Picus villosus* (hairy woodpecker). In Europe, the following Ichneumonid parasites have been reared:—*Cryptus flagitator*, *Pimpla heraclei*, *Hoplismenus dimidiatus*, *C. profligator*, and *Ophion vulnerator*. No very efficient remedy is known. Spraying with lead arsenate or Paris green just as the larvae are hatching has little effect. Dusting with Paris green or air-slaked lime, when the umbels are open, gives better results. The removal of all infested seed heads is not advocated, as it would mean the total destruction of the crop and the effect would not be permanent if wild host plants were abundant. As a rule the latter are too numerous to be completely eradicated.

TOTHILL (J. D.). **The Introduction and Establishment in Canada of the Natural Enemies of the Brown-Tail and Gipsy moths.**—*Agric. Gaz. of Canada, Ottawa,* iii, no. 2, February 1916, pp. 111–116, 1 map, 1 table.

The gipsy moth [*Lymantria dispar*] and the brown-tail moth [*Euproctis chrysorrhoea*] are rapidly spreading northward into Canada from the New England States. At the present time, the brown-tail moth is firmly established in Nova Scotia, while New Brunswick is reinfested from year to year if favourable winds occur at the time of flight. The gipsy moth has not yet reached Canada. To prevent any future attack on the northern forests of the Dominion, protective measures, in the form of the introduction of insect enemies, are being undertaken. Since 1912, the following predaceous and parasitic insects have been reared and liberated:—*Compsilura concinnata, Calosoma sycophanta, Meteorus versicolor* and *Apanteles lacteicolor.* No attempts have yet been made to recover *C. concinnata* or *C. sycophanta* from the field, but *A. lacteicolor* is rapidly increasing in numbers and has been recovered from the winter webs of *E. chrysorrhoea.*

DIETZ (H. F.) & MORRISON (H.). ***Phenacaspis spinicola,* n. sp.; an apparently New Coccid from Indiana (Hem., Hom.).**—*Entom. News, Philadelphia,* xxvii, no. 3, March 1916, pp. 101–102, 1 fig.

A preliminary description is given of *Phenacaspis spinicola,* sp. n., a Coccid obtained from the bark, spines, twigs and leaves of *Gleditsia triacanthos* (common honey locust), near Vincennes and Indianapolis, Indiana, during August and September 1915.

HOOD (J. D.). **A New Species of *Heterothrips* (Thysanoptera) from Eastern United States.**—*Entom. News, Philadelphia,* xxvii, no. 3, March 1916, pp. 106–108.

Heterothrips vitis, sp. n., is described from Maryland on flowers of wild grape, *Smilax* and *Rhus toxicodendron,* and from Columbia and Virginia on flowers of wild grape.

SURFACE (H. A.). **New Pest attacks Fruit-Trees.**—*Penns. Dept. Agric., Harrisburg, Weekly Press Bull.* no. 9, 2nd March 1916.

The red leaf beetle [*Galerucella cavicollis*] has been very destructive in several counties in the northern and central portions of Pennsylvania, feeding upon foliage of cherry, peach, apple, pear and some other trees, shrubs and plants. The native food-plant of the adult beetle and its larva is *Prunus pennsylvanicus* (Pennsylvania fire cherry). The larva does not feed on any other species, but completely defoliates this tree, and while the adult feeds on many trees, especially the cultivated cherry, peach and plum, and sometimes upon apple and pear, it does not oviposit on them. The best general remedy is to destroy the fire cherry trees (which have no economic value), but the best local remedy consists in spraying with lead arsenate, 1 oz. in 1 U.S. gal. of water, whenever the beetles or their larvae are destructive.

CAESAR (L.). **The Fruit-Tree Leaf-Roller.**—*Canadian Horticulturist, Peterboro, Ont.*, xxxix, no. 2, February 1916, pp. 21-22, 3 figs.

Apple and pear trees in Ontario are attacked by two leaf-rolling insects, namely the oblique-banded leaf-roller [*Cacoecia rosaceana*] and the fruit-tree leaf-roller [*C. argyrospila*]. The latter has proved especially injurious in some orchards, where from 40 to 50 per cent. of the crop has been injured or destroyed. The eggs are laid during July on the upper side of two- or three-year-old twigs. Larvae emerge at the time of the bursting of the buds. They attack the leaves first, then the flower buds and fruit. Maturity is reached by the middle of June and adults appear at the beginning of July. Young leaves and blossoms are webbed together by the larvae, while fruit which is severely attacked falls to the ground. When weeds or clover are present in the orchard, the larvae may feed on them, though eggs have never been found on these plants. Both larvae and pupae are attacked by parasitic and predaceous enemies, but not in sufficient numbers to effect control. Lead arsenate spray (4 lb. lead arsenate to 40 gals. dilute lime-sulphur or Bordeaux mixture) applied first just before the blossoms open, and again immediately after they have fallen, kills about 50 per cent. of the larvae. A better remedy is a miscible oil spray, which must be applied just before the leaf-buds open. Severe pruning before the operation will save spraying material. Good cultivation throughout June will destroy many larvae and pupae.

SANDERS (G. E.). **The Control of Fruit Insects, with Special Reference to Nova Scotia.**—*Canadian Horticulturist, Peterboro, Ont.*, xxxix, no. 2, February 1916, pp. 25-26, 2 figs.

The investigation of apple insects in Nova Scotia during the past four years has demonstrated very clearly the value of the study of insects under local conditions. Very frequently in this province the growth of the apple buds is retarded, after opening, by a cold period, though insect life during such a time is not retarded to a similar extent. The time of spraying must therefore be adapted to these conditions. For the control of the bud moth [*Eucosma ocellana*] in 1915, applications of lead arsenate were made on the 15th and 31st May, then twice more after the blossoms had fallen. In this way 92 per cent. of the larvae were killed. The control of fruit-worms, the most important of which is *Graptolitha* (*Xylina*) *bethunei*, lies in having the leaves coated with poison during the period of emergence from the egg, i.e., at the time when the flower buds are showing pink. A second spray is given immediately after flowering. The codling moth [*Cydia pomonella*] is of minor importance, injury only amounting to 1·7 per cent. of the crop. There is a single brood annually. In view of the slight importance of this insect, the first spray after flowering may be advanced or retarded as desired.

Herrick (G. W.) & Leiby (R. W.). The Fruit-Tree Leaf-Roller.— *Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 367, December 1915, 32 pp., 17 figs. [Received 18th March 1916.]

In 1911 the Tortricid, *Cacoecia* (*Archips*) *argyrospila*, Walk. (fruit-tree leaf-roller) suddenly came into prominence in New York State as causing serious injury to apples and minor injury to pears; during the seasons of 1912, 1913 and 1914 the insect fully maintained its importance as a pest. The first reference to its activity as a pest of economic importance would appear to be one by Packard in 1870, while Lintner reported it in 1889 as a pest in New York State. According to Gillette, it was abundant in Colorado in 1890, if not earlier. In 1905 it became very destructive in Missouri and during the past few years it has greatly increased in parts of Colorado and New Mexico, where it has been carefully investigated and experiments have been made on its control by Gill [see this *Review*, Ser. A, i, p. 225]. *C. argyrospila* is evidently one of those insects that fluctuate markedly in numbers and destructiveness; it even appears to migrate from one orchard to another in successive seasons. As the larva of this species is very similar to that of *C. rosaceana*, the only safe way of determining the host-plant is by breeding the adult. Details are given regarding distribution, food-plants, habits, injuries and life-history. The parasite of this species which was bred in the largest numbers at the Cornell insectary was the Ichneumon, *Pimpla conquisitor*, which must have destroyed many of the larvae. Other parasites were a species of *Amicroplus*, twenty-three specimens of which were bred from one larva; single specimens each of the Ichneumons, *Phytodietus vulgaris*, *Pimpla inquisitor* and *Glypta simplicipes*, which appears to be rather abundant in the field; a specimen of a Chalcid, *Sympiesis* sp.; and a single Tachinid, *Carcelia nigropalpus*. Experiments showed that light traps were not of great efficiency in the control of *C. argyrospila*, though useful data were obtained by their means. Detailed accounts are given of trials with insecticides. It was found that the eggs of this moth are susceptible to the effect of miscible oils, which, when thoroughly applied, have destroyed from 74 to 92 per cent. of them. In Colorado, New Mexico, and Oregon, where these oils have also been used extensively [see this *Review*, Ser. A, iii, p. 758], an even higher proportion of the eggs has been destroyed. In experiments made during the past three years no injury has resulted from the use of miscible oils. They have been applied in the spring (April) at as near the active growing period of the tree as possible, but always before the buds burst, generally at the rate of 1 gallon to 15 gallons of water. Only one application should be made, and that on a day when the temperature is above freezing. In cases of severe infestation the oils should be supplemented by thorough sprayings with arsenate of lead at the rate of 6 lb. to 100 U.S. gals. of water or of lime-sulphur solution. At least one application should be made before the blossoms open, and another after the petals fall; the latter will serve also as the regular spraying for codling moth [*Cydia pomonella*]. In lightly infested orchards spraying with miscible oils may be omitted and reliance placed on thorough applications of lead arsenate or lime-sulphur. One or two applications should be made before the blossoms open and another after the petals fall. A list of 18 works closes this paper.

Reddick (D.) & Crosby (C. R.). **Dusting and Spraying Experiments with Apples.**—*Cornell Univ. Agric. Expt. Sta., Ithaca, N.Y.*, Bull. no. 369, January 1916, pp. 306–356, 14 figs,, 13 tables. [Received 18th March 1916.]

Experiments carried out during 1915 in various orchards in New York State showed that a mixture of an insecticide and a fungicide can be applied in powdered form, using air as a carrier, with better commercial results in the control of apple insects and diseases than can be obtained by spraying. The dusting method cannot as yet be completely substituted for liquid spraying, since no known powder will destroy scale-insects, Aphids and pear psylla. Under average western New York conditions good results can be obtained from a mixture containing 85 per cent. of finely ground sulphur and 15 per cent. of powdered arsenate of lead, the amount varying from 1·25 to 2·5 lb. per tree in each application. The time of spraying does not differ from that of liquid sprays, but it is also possible to make applications at unusual times in order to meet special conditions. The method has as yet only been thoroughly tested on apples, but there are indications that its use can be extended to other crops. On some varieties of grapes undiluted dust mixtures cannot be used, owing to the injurious effect of the sulphur.

Snyder (T. E.). **Termites, or "White Ants," in the United States: their Damage, and Methods of Prevention.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 333, 16th February 1916, 32 pp., 5 figs., 15 plates.

In the United States the three most common species of termites are *Leucotermes flavipes*, *L. lucifugus* and *L. virginicus*. *L. flavipes* occurs throughout the country and has also been reported from Europe and Japan. *L. lucifugus* is found in Texas, Arizona, Kansas, Colorado and South California, as well as in the Mediterranean regions of Europe, western France and Hungary. The native species, *L. virginicus* is recorded from the District of Columbia, Maryland, and Virginia.

The three species are similar in habit, being subterranean wood-destroying forms. Nests are made in the wood of dead trees, stumps, or decaying logs, or in underground passages beneath wood or other vegetation. The nests are temporary structures, there being seasonal changes in the life of the colony. The burrows of other wood-boring insects are often enlarged and inhabited by termites. The centre of activity of the colonies varies with climatic conditions. In dry regions the burrows are deep, and in the summer the more exposed galleries are vacated for the deeper portions. In northern Virginia, life from late October to early March is entirely below ground. When conditions become unfavourable, the nest is abandoned and a new site found. A mature colony contains several thousand individuals; an incipient colony is small and the increase in numbers is slow. Newly-hatched larvae are similar in appearance and may develop into soldier, worker, or reproductive forms. The young are often kept in an undifferentiated state and can be changed rapidly into supplementary reproductive forms of both sexes if necessary. The development of the soldiers and workers is completed in less than a

year; the nymphs of the reproductive forms require two years to reach maturity. The king and queen probably live together for several years, under normal conditions. The swarming of the winged, sexual individuals of *L. flavipes* occurs in April or early May in the southern States, and in late May or early June in the north. *L. virginicus* swarms early in June, or as late as August in northern Virginia, and *L. lucifugus* from the middle of October to April in Texas, Kansas and Colorado. The distance of flight is from 75 to 100 feet, but may be increased if the insects are carried by the wind. During this time, they are preyed on by numerous birds, spiders, centipedes, crickets, etc. Mating occurs during or after swarming, and pairing takes place about a week later in the cell which marks the site of a new colony, and is repeated at intervals for several years. Egg-laying, in the case of newly-formed colonies of *L. flavipes*, begins in June or July in the south-eastern States. The first egg-cluster contains from 6 to 12 eggs; these are deposited in the royal cell and hatch in about 10 days. The larvae from the first batch develop mainly into workers. The second egg-laying takes place about six months later; subsequently, pairing and oviposition occur at shorter intervals. No types of reproductive form ever lose the power of locomotion completely; hence there is no permanent royal cell and the cold season is passed in the ground below the frost line. In well-established colonies in northern Virginia, the period of maximum egg-production is from the middle of May to September. In infested buildings activity is maintained throughout the year.

The most serious damage is that done to timbers in buildings which are in contact with the ground; living trees, shrubs, and crops are rarely attacked, and then only because much decaying wood or humus is present in the soil. As a rule in the United States attack on foundation timber is only begun when the latter is in a moist or decaying condition. In the southern United States the stems and roots of cotton, maize, sugar-cane, rice, grasses and garden vegetables are sometimes injured. The damage in some cases is primary, but in others the plants attacked are those which have been killed by fungus diseases. Nursery stock is often attacked at a scar or at the point of grafting. To prevent, as far as possible, the attack on the bases of buildings, the foundations should be entirely of brick, stone, or concrete, without beams sunk in the ground. Complete dryness is an important means of rendering buildings safe from attack. The following woods are resistant to attack, owing to the presence of oils, alkaloids, gums, or resins, and on account of their hardness:—California redwood, black walnut, teak, peroba, mahogany, some conifers, and *Eucalyptus diversicolor* (karri) and *E. marginata* (jarrah) of Australia. The site of a colony is indicated by the presence of grass and earth thrown out of crevices and by the point of emergence of the swarm. If damaged woodwork in foundations cannot be replaced by stone or concrete, wood impregnated with a 6 per cent. solution of zinc chloride or a 1 per cent. solution of bichloride of mercury should be used. Kerosene poured into crevices through which winged individuals emerge, affords a temporary remedial measure. For poles, posts, etc., coal-tar creosote is the best repellant; for furniture, chlorinated naphthaline is effective. Wood-pulp products may be treated with a solution of dihydrogen potassium arsenate or a 2 per cent. solution

of sodium fluoride. Fumigation with hydrocyanic acid is useful for books, papers and other stored material. In the case of forest trees, care should be taken that they do not become scarred near the base and any cuts should be painted with coal tar. Clean cultivation should be practised, and the ploughing under of old stubble in fields should be discontinued.

JARVIS (E.). **Combating the Cane Beetle.**—*Queensland Agric. Jl., Brisbane*, v, no. 2, February 1916, pp. 102–103.

During November, the rainfall was insufficient to produce soil conditions suitable for the emergence of *Lepidiota albohirta.* Two root-eating Scarabaeid beetles, *Dasygnathus* sp. and *Anomala* sp., appeared in the cane fields in the middle of the month. The indiscriminate felling of all trees, including the food-plants of *L. albohirta*, in the vicinity of an infested cane field, is not to be recommended in all cases. The success of this method of procedure depends largely on the geographical position of the infested area, as well as on the soil conditions. From observations made at Gordonvale, it may be inferred that in certain soils this beetle is unable to remain alive for more than ten weeks during dry weather.

JACK (R. W.). **Rhodesian Citrus Pests.**—*Rhodesia Agric. Jl., Salisbury*, xiii, no. 1, February 1916, pp. 69–83, 3 plates.

Citrus trees in Rhodesia are but little injured by insect pests but they may be attacked by the following:—*Chrysomphalus aurantii* (red scale) which is distributed throughout southern Rhodesia, attacking citrus trees of all sorts, especially lemon, orange and grape-fruit; naartje trees appear to suffer but little from this pest. *C. aonidum* (circular purple scale) is not generally distributed as an outdoor pest in Rhodesia, but, where it occurs, it appears to thrive quite as well as *C. aurantii. Selenaspidus silvaticus* (larger red scale) has been found on the foliage of orange and lemon; it is common on palms under glass and was probably introduced by this agency. Up to now it cannot be considered a pest of citrus. *Lepidosaphes beckii* (purple or mussel scale) occurs near Umtali, where it is only found on citrus. *Coccus hesperidum* (brown or soft scale) is the most prevalent scale in citrus orchards, and few are entirely free from it. Natural enemies control it to some extent, including the caterpillars of a species of *Eublemma. Icerya purchasi* (Australian bug) is kept from doing serious damage by the imported Coccinellid, *Novius cardinalis*, and by *Aulis foedata*, a native species. The latter seems to be a very effective check in Southern Rhodesia.

HERRICK (G. W.). **The Need of a Broad, Liberal Training for an Economic Entomologist.**—*Jl. Econ. Entom. Concord*, ix, no. 1, February 1916, pp. 15–23.

The author in his presidential address urges the necessity for a thorough and extensive preparation on the part of those intending to become economic entomologists. He points out the increasing importance of economic entomology in the development of rural life, and the need for complete knowledge of the theoretical and practical aspects of the problems of applied entomology are clearly brought out.

McColloch (J. W.) & Hayes (W. P.). A Preliminary Report on the Life-Economy of *Solenopsis molesta*, Say.—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 23-28, 1 fig., 1 plate, 4 tables.

The ant, *Solenopsis molesta*, which is distributed over the eastern half of the United States, is primarily injurious, although it has been known to prey on other insects and to act as a scavenger. Damage to maize, strawberries, blackberries and sweet foods found in houses has been reported from various districts. In Kansas the chief injury consists in the destruction of the seeds of sorghum, sugar, maize, etc., shortly after planting. By means of a suitable breeding cage, which is described, the life-history was studied.

Damage to kafir corn and other sorghums in Kansas may occur before or after germination. Forbes is of the opinion that the ants attack the interior of the seed for the purpose of obtaining the oil. Seeds injured after germination produce weak plants which soon die. Workers have also been found feeding on windfall apples and plums, dead grasshoppers, larvae, pupae and adults of *Sphenophorus maidis*, Chittn. (maize bill-bug), larvae of *Papaipema nebris*, Gn. (*nitela*, Gn.) (corn-stalk borer), larvae of *Mayetiola destructor*, Say (Hessian fly), grasshopper eggs, pupae of *Chloridea obsoleta*, F. (corn ear-worm), and larvae of *Hemerocampa* (*Notolophus*) *leucostigma*, S. and A. (tussock moth)

S. molesta generally builds compound nests with other ants, which are robbed of eggs, larvae, and pupae. In natural formicaries, winged males and females appear in July, but in artificial nests the queens were never fertilised. The workers are preyed upon by the ants, *Cremastogaster lineolata*, Say, and *Pheidole pilifera*, Roger, by *Phrynosoma cornutum* (horned toad) and by *Eumeces* sp. (skink). A mite, *Hyposapis* sp., is probably ectoparasitic on the workers, queens and eggs.

Four methods are suggested for the protection of seed against attack:—(1) Autumn ploughing, whereby germination is hastened and nests of *S. molesta* are broken up; (2) early planting, about 10th May; (3) surface planting; (4) the use of repellents. Kerosene and turpentine have a repellent action for a short time; Black Leaf 40 and crude carbolic acid apparently do not hinder germination. Further experiments in this direction are being carried out.

Somes (M. P.). Some Insects of *Solanum carolinense*, L., and their economic relations.—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 39-44.

Solanum carolinense, L. (horse-nettle) is a common weed in the United States and especially in Missouri. It is allied to such cultivated plants as tomato, potato and tobacco, and it has been found that insects which commonly feed on *S. carolinense* may transfer themselves to one of these cultivated forms, thus becoming more or less serious pests. In July 1914, *Jalysus spinosus*, Say, a widely distributed Berytid bug feeding on *S. carolinense*, caused serious injury to tomatoes near St. Louis by puncturing the fruit stems and ovaries. During the past two years this insect has become very important in Missouri, where

there are three or four broods a season, the adults hibernating beneath leaves and other waste material. In August 1914, adults of *Aegeria (Sesia) rileyana*, Dry., were found on *S. carolinense*. Larvae were found in the stems of this plant on 24th May 1915, the tunnels running in the central portion from the main branches to the roots. When mature, the larva emerges through the roots and pupates in the soil at a short distance from the plant. The majority of adults emerge from the middle of August to the middle of September. Larvae of *A. rileyana* were transferred to the stems of tomato and potato during June. These plants proved to be suitable hosts; the larvae rapidly bored into the tissues and developed normally. Observations made under natural and experimental conditions showed that the insects thrive best under conditions of drought. Larvae of *Cassida pallidula*, Boh., were transferred from horse nettle to potato and tomato on 30th June. Feeding began at once; pupation occurred on 9th July and adults emerged on 14th July. Pairing was observed to take place a day later, while eggs were laid on tomato on the 17th and on potato on the 19th July. The eggs hatched in from 9 to 13 days; larvae became mature in about a month, while the pupal period lasted from 6 to 10 days. The Tingitid bug, *Gargaphia solani*, Heid., occurring abundantly on horse nettle, was successfully placed on tomato and potato; the leaves soon showed black spots which marked the feeding punctures. Egg-clusters placed on the same plants hatched in from eight to nine days. Transfers of the weevil, *Trichobaris trinotata*, Say, from *S. carolinense* were made successfully. In the case of those placed on tomato, the insect transformed to the adult stage within the burrow and hibernated in this position. Eggs were deposited in holes pierced in the axils of the upper leaves or branches and the larvae gradually worked downwards to the base of the stem for transformation. The flea-beetles, *Epitrix fuscula*, Crotch, and *E. cucumeris*, Harr., were readily transferred from the wild food-plant. There are probably at least three broods of these insects annually in Missouri. The Sphingids, *Protoparce (Phlegethontius) carolina*, L., and *P. quinquemaculata*, Haw., showed a similar liking for potato and tomato. Experiments with the Lygaeid bug, *Ischnodemus fallicus*, Say, and two leaf-rollers of *S. carolinense* are being carried out.

PATCH (Edith M.). **Concerning Problems in Aphid Ecology.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 44–51.

The migratory habit of certain Aphids renders the life-cycle difficult to determine, but may be of use economically in affording a greater choice in methods of control. It has been shown that *Anoecia (Schizoneura) corni*, F., on dogwood and *A. venusta*, Pass., on grass roots, in Europe, are the same species, as is also *A. panicola*, Thom., on grasses in North America. *Pemphigus tessellata* of alder and *P. acerifolii* of maple are stages in the life-history of the same species, etc. In Maine, *Eriosoma (S.) lanigerum*, the woolly aphis of apple, has an overwintering form on the elm, but in Europe no such record has been made. The host which serves for the deposition of the over-wintering egg and for the development of the stem-mother and her progeny is termed the primary host, while that to which the spring migrants fly is the secondary host. Many migratory species alternate between

these two hosts at regular intervals; for example, *Rhopalosiphum nympheae*, L., lives in winter and spring on the plum and in summer on various water plants.

Certain individuals among plants appear to be immune to attack, although growing by the side of heavily infested plants. Owing to the great variability in the behaviour of the migrants, repeated tests are necessary before data can be definitely established. As a rule, it is simpler to work with the progeny of the spring migrants than with the autumn return forms, since the proof of the validity of a tested food-plant rests on the ability of the offspring of the migrants to develop on it.

WHITMARSH (R. D.). **Life-History Notes on *Apateticus cynicus* and *maculiventris*.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 51–53.

The Pentatomid, *Apateticus cynicus*, Say, the most common of the predaceous brown stink-bugs, is single-brooded. Eggs are deposited in late autumn in masses containing about 45 eggs. Young emerge between the middle of April and the middle of May, and under favourable conditions reach maturity in about six weeks. Pairing occurs about three weeks after the adult stage is reached and is continued at intervals throughout the summer. Males begin to die off at the beginning of September, while the females live for some weeks longer and deposit eggs. From the time the second instar is reached, the insect is predaceous upon unprotected individuals of its own species and upon Lepidopterous larvae, such as those of *Datana integerrima*, *D. ministra*, *D. angusi*, *Halisidota caryae* and *Callosamia promethea*.

A. maculiventris, Say, begins to oviposit during the latter part of May or early June; each egg-mass contains from 20 to 30 eggs. Larvae hatch out in three days and feed during early life on Aphids and newly-hatched larvae of beetles, moths and butterflies. They exhibit a marked dislike for hairy caterpillars. Later, the food consists of the larval forms of the elm leaf beetle [*Galerucella luteola*], the potato beetle [*Leptinotarsa decemlineata*], etc. The winter is passed in the adult stage in a sheltered place.

GOSSARD (H. A.). **The Distribution of the Periodical Cicada in Ohio.** —*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 53–59, 4 figs., 1 table.

The distribution of the periodical cicada [*Tibicen septemdecim*] in Ohio in 1906, 1914 and 1915 is illustrated by maps. In the 1914 report the first records were as early from the northern as from the southern parts of the State, but the dates of disappearance were progressively later, going towards the north. It is probable that the insects are thinly distributed in the western counties, outside the territory hitherto regarded as inhabited by the brood. Pupae were collected at Wooster during the last 10 days in April and adults were recorded on 25th May. Oviposition began on 5th or 6th June. The map for 1915 was constructed from 227 reports, of which 38 affirmed the presence of the insect in small numbers. In Mahoning county larvae were numerous in the upper layers of the soil in April and May, but did not appear in large numbers as adults.

Gossard (H. A.). Is the Hive a Center for distributing Fire Blight? Is Aphid Honey Dew a Medium for spreading Blight?—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 59–64, 2 plates.

Examination of cultures made from old honey, taken from hives early in the spring, failed to show the presence of the organism of fire-blight. Cultures made during the apple-blooming period from fresh apple honey, which had been carried from orchards blighted during the previous year, were also negative. When bacilli were inoculated into sterilised honey, and the culture, after a varying period, was introduced into the growing tips of apple shoots, it was found that the organism can remain virulent in honey for 47 hours and then produce infection. No infection was obtained after a certain limit of incubation; hence it may be supposed that the bacteria survive for some time without multiplication. It is possible that multiplication may take place in the nectar in the state in which it is carried into the hive. If this is so, the bees which work on the nectar at night carry virulent bacteria to the blossoms on the next or the following day. This would explain to a great extent the rapid infection which occurs in the latter part of the blooming period.

Drops of Aphid honey-dew, a substance similar in composition to nectar, were placed on leaves of infected apple trees. At the end of 20¼ hours, 43 hours, and 71 hours respectively, this culture was inoculated into clean apple shoots. Inoculations resulted in 66·6, 83·3, and 100 per cent. of infection respectively. The habit of ants of visiting colonies of woolly Aphids present in spring in old but living blight cankers, and then of visiting green Aphids on the expanding buds, which in turn are visited by bees and flies in quest of honey-dew, may be of significance in blight control.

In the discussion following the paper, Mr. J. H. Merrill stated that in Kansas, in 1913, a contact insecticide was used against green aphis on unopened apple buds. Later in the season, the sprayed orchards were practically free from blight, while in unsprayed orchards the disease was prevalent. In 1914, both Aphids and blight were rare, while in 1915, conditions were similar to those of 1913. The speaker therefore concluded that Aphids were one of the chief distributors of blight. Mr. T. J. Headlee believed that the type of cultivation was an important factor in the prevalence of blight, the damage caused by the disease being greater in neglected orchards in which a rainy season had induced greater succulence of the trees. Failure to spray might be followed by abundance of Aphids and fire-blight without there being any essential connection between them.

Paddock (F. B.). Observations on the Turnip Louse.—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 67–71.

Observations on *Aphis pseudobrassicae*, sp. n. (turnip louse) were begun in Texas in 1913, at which date the insect was becoming destructive over the entire State. The following plants, in order of importance, were attacked:—turnip, radish, mustard, rape, cabbage, kale, kohl-rabi, bean and lettuce. The reproduction of this insect in Texas appears to be entirely asexual and is continuous throughout the year. A winter temperature of from 15° to 20° F. is common and

the number of young then produced is small. A similar reduction in the number of young and a lengthening of the developmental stages occurs in hot, dry weather. In 1914, 20 generations occurred between 18th January and 6th August, while in a year dating from 14th September 1914, 35 generations were produced. The average number of young arising in the generations of the two series was 80 and 93 respectively. *Aphis brassicae* (cabbage louse) and *Myzus persicae*, Sulz. (green peach aphis) were often found on the same hosts as *A. pseudobrassicae*. The first two species were more resistant to climatic changes, and to insect and fungus attacks, than the turnip aphis. The most widely distributed parasite of the latter was *Lysiphlebus testaceipes*, Cress. Another Braconid, *Diaeretus rapae*, Curt., was abundant at College Station, but less common in the southern parts of the State. This species was able to survive a temperature of 17° F. to which the host insects were exposed. Between September 1914 and May 1915, predaceous enemies were of more importance than the above parasites in controlling *A. pseudobrassicae*. The Coccinellids, *Hippodamia convergens*, Guér., *Megilla maculata*, de G., and *Coccinella munda*, Say, were present wherever the Aphids occurred. *H. convergens* was active and abundant in autumn and spring, and *M. maculata* during the winter. The Syrphid flies, *Syrphus americanus*, Wied., and *Allograpta obliqua*, Say, were numerous, the latter species occurring in the more southern portions of the State. *Chrysopa* sp. was generally distributed. A fungus, probably *Empusa aphidius*, caused heavy mortality in the latter part of 1913 and the early part of 1914.

Experiments on the artificial control of this Aphid showed that spraying with soap solutions gave satisfactory results.

GOSSARD (H. A.). **The Clover Leaf-Tyer** (*Ancylis angulifasciana*, **Zeller**).—*Jl. Econ. Entom.*, *Concord*, ix, no. 1, February 1916, pp. 80–82.

Ancylis angulifasciana, is always present in clover fields in Ohio, causing more or less serious damage. The known food-plants are the common red, alsike and white clovers; lucerne is rarely attacked. The leaflets on one or more petioles are tied together with silk, and within the cell so formed, the larva feeds and undergoes pupation. There are three broods annually. The first adults appear in late April and early May; eggs are laid on the leaflets and hatch out in two or three weeks. Larvae are found from about 1st June to 20th June. The pupal period lasts from 7 to 14 days, and the second brood of moths is present from about 1st July to 20th July. The second generation of larvae occurs between 20th July and 15th August, and pupae between the latter date and 20th September. The third brood of larvae feeds from the middle of September until November, when they spin cocoons in which the winter is passed and in which some feeding may take place. Normal feeding is resumed in April and pupation occurs in the middle of that month.

Many of the larvae and pupae of the first brood are destroyed at the first clover harvest, while the second cutting kills many of the second brood. The third brood may be destroyed by autumn pasturage.

Houser (J. S.). **Dasyneura ulmea, Felt; a New Elm Pest.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 82–84, 1 fig.

Perrisia (Dasyneura) ulmea, Felt, is apparently generally distributed throughout southern Ohio. The damage consists of the formation of aborted bud-galls on elms, usually at the tips of the twigs, resulting in the checking of branch development. In the most severe cases observed, 70 per cent. or more of the branches were affected. Preference is shown for individual trees of *Ulmus americana*. Larvae may be found in the galls of infested trees between midsummer and the following spring; from one to eight are present in each gall. The egg and pupal stages were not observed by the author. A Chalcid, *Callimome* sp., has been reared from the larva. The best control measure seems to be the cutting away of all twigs bearing aborted buds before growth begins in spring. The twigs should be left on the ground for the parasites to emerge, the host insects being killed by the drying up of the galls.

Headlee (T. J.). **Sulphur-Arsenical Dusts against the Strawberry Weevil (*Anthonomus signatus*, Say).**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 84–89, 1 fig., 1 table.

Injury to strawberry plants by *Anthonomus signatus*, Say, is due primarily to the oviposition habits of the female. Eggs are laid in the unopened staminate flower buds; attack begins when the buds open, and continues for about two weeks. In addition to the cultivated strawberry, the following may serve as food-plants:—Wild strawberry, blackberry, dewberry, black-capped raspberry, *Potentilla canadensis* (yellow flowered cinquefoil), *Cercis canadensis* (red-bud tree), etc. Chittenden, in 1897, suggested the following measures of control: (1) covering the beds with muslin; (2) cultivation of pistillate or of profusely blooming varieties; (3) the use of trap crops and clean culture. Bordeaux mixture, or Paris green and arsenate of lead, alone or combined with Bordeaux, were recommended as repellents. The above measures have either proved impracticable or have not been successful. The wide range of food-plants renders clean culture and trap crops useless, except in districts free from woodlands or waste lands, and the problem of control is thus one of making the food-plants distasteful or poisonous during the two weeks in which injury occurs. The effect of certain contact insecticides, stomach poisons and pure repellents on the weevil was tested, and it was found that a mixture of 1 lb. lead arsenate powder and 1 lb. sulphur dusted over the plants afforded almost perfect protection, and caused no injury to the leaves. Later applications made on 18th May did not damage the open blossoms. The minimum cost of the mixture was 5d. per lb., and about 78 lb. was required per acre. The mixture acted solely as a repellent, the weevils being destroyed in very few cases. According to Mr. W. Moore, in Minnesota this weevil returns to the strawberry plots in late summer or autumn, and feeds on the leaves, whereas in New Jersey hibernation in woodlands occurs.

GOODWIN (W. H.). **The Control of the Grape Berry Worm (*Polychrosis viteana*, Clem.).**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 91-106.

Polychrosis viteana in Ohio passes the winter in the pupal stage within a cocoon formed inside a folded leaf. The leaves are either on the surface of the soil or are partly buried and are always moist. The pupal cases frequently become detached and are carried off by snow or heavy rain. Several vineyards are known to have been freed from this insect for a season by winter flooding. A low temperature and dry soil increases the mortality among the pupae. Adults emerge during the first week in June, when the vines are in blossom. In confinement, eggs are laid from four to seven days after emergence, but some individuals remain for a longer period before oviposition begins. Adults of this brood live from 10 to 17 days, thus giving an extended egg-laying period. The larva webs together a cluster of developing berries and feeds on the pulp until mature. Pupation takes place in a cocoon formed on the young leaves. Adults appear from the latter half of July to the middle of September, according to the latitude. Moths emerging at the beginning of August commence egg-laying in from three to five days and continue to do so for from seven to eleven days, the eggs being glued to the stalk of the berry or to the berry itself. The larvae develop during August and September, webbing together the berries as they feed. The juice of abandoned berries ferments and evaporates, so that ultimately only the shell is left.

Experimental work on the control of *P. viteana* was carried out at intervals between 1907 and 1915, various insecticides, fungicides, adhesive substances and different kinds of spraying apparatus being tested. In 1907 and 1908, applications of spray were made just before the grapes bloomed and again between 18th and 22nd June and 10th and 15th July. Vines handsprayed with Bordeaux and laundry soap gave the smallest percentage of infested fruit. In 1909, a spray consisting of lime-sulphur (1 in 50) and 3 lb. lead arsenate was found to defoliate the plants treated and also to destroy the fruit. The experimental plots in 1913 were sprayed between 9th and 12th June, 18th and 21st June, and 18th and 21st July. The bulk of the moths were found to emerge after the third application, this result indicating that the final spray should have been given two or three weeks later. Arsenate of lead with Bordeaux (2-3-50), and 1 lb. of soap, applied at a pressure of 200 lb. gave the best results. The experiments of 1913 and 1914 showed that the spray applied before flowering and that given five to eight days after blooming were of less value than a spray applied in August. Some of the most satisfactory results were obtained in vineyards which received only one thorough spraying in August with 3 lb. powdered arsenate of lead in combination with 2-3-50 Bordeaux and 2 lb. soft soap. In 1915, a more extensive series of experiments was undertaken in several districts in northern Ohio. The collection of the moist leaves containing pupae, in the previous autumn, resulted in a material reduction in the number of moths. Ploughing in the latter part of May was also partly effective. In the spraying tests, the best results were secured by heavy applications of from 4 to 6 lb. lead arsenate paste in 50 gals. Bordeaux with 2 lb. soft soap, made first in the week following flowering, and again six or

seven weeks later. The second spray in northern Ohio came between 3rd and 12th August, and was applied preferably by the trailer method. The June spraying required from 100 to 120 gals. per acre, the August spray 160 gals. per acre, applied by hand, and containing the larger quantity of lead arsenate. The total weight of the crop from well-sprayed vines was from two to five times greater than that from unsprayed plants.

In the discussion which followed, the author said that there were two broods annually. Hatching was distributed over a period of four or five weeks; in northern Ohio, most of the first brood moths emerged from the 5th to 12th August, from 90 to 95 per cent. appearing in between seven and nine days. A thorough hand spraying at this time poisoned most of the larvae soon after hatching.

FELT (E. P.). **Climate and Variations in the Habits of the Codling Moth.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 107-110.

The habits and type of injury caused by the codling moth [*Cydia pomonella*] in New York State are influenced to a considerable extent by climatic conditions. During 1915, 20 per cent. or more of the crop suffered from what is called "side injury," a reddish-brown discoloration marked by a central puncture. This type of injury is due to larvae hatching from eggs deposited in June or early July, after the fruit has attained a considerable size. The larvae eat a shallow circular gallery immediately beneath the skin, but in many cases desert this point and migrate to the blossom end of the fruit. Side injury in 1915 was more prevalent in the west, near Lake Ontario, than in other parts of the State, and was probably common in other localities where a large body of water prevented a marked rise of evening temperatures in the spring. Eggs are rarely deposited when the evening temperature falls below 60° F. Records from inland districts removed from the influence of water have shown that at temperatures above 60° F. egg-laying proceeds normally and in such localities there is little side injury. Ordinary applications of arsenical poisons cannot be relied on to destroy larvae hatching from late deposited eggs before they have injured the fruit to some extent. Side injury must be controlled to a considerable extent during the preceding year by applying arsenical sprays.

BILSING (S. W.). **Life-History of the Pecan Twig Girdler.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 110-115.

Oncideres texana may cause serious damage to pecan trees, the cultivation of which has become an important industry in Texas, by the girdling of the branches for the purpose of egg-laying. This beetle has also been found on persimmon, elm, hickory, maple, pear, peach, etc. Oviposition begins after the twig has been girdled; the central portion is generally left intact, but the weight of the branch is often sufficient to cause it to break off. Eggs are laid singly, or rarely in groups of three or four, at the base of the leaf buds, in an incision made in the bark. During the oviposition period, both male and female feed on the soft wood at the base of the leaf buds at the extremity of the branch. When nurseries are adjacent to forests,

severe damage is often caused by migration of the adults from the surrounding trees. Females emerge from 25th August until the beginning of October. Oviposition begins from 12 to 29 days later, and may continue until December. About 175 eggs are deposited on an average by each female. The larva, which hatches in from 17 to 30 days, hollows out a cavity in the branch and feeds throughout the winter. The larval stage lasts from 288 to 328 days. Pupation occurs late in August or early in September, and the pupal stage, lasting for 12 or 14 days, is passed in the pupal burrow.

The method of control by gathering fallen twigs and burning them in order to kill the larvae is practicable only where a pecan orchard is not situated near other trees. Experiments with lead arsenate proved effective in preventing migration to the pecan trees.

In the discussion following, it was stated that the female usually oviposits in the main twigs, the girdles being cut at a distance of about 2 feet from the trunks of the smaller trees. In breeding experiments, moisture proved to be an important factor. A small number of larvae survived in branches which remained on the ground. Beetles were not observed girdling branches which sloped downwards. A considerable percentage of adults were parasitised by a Tachinid fly.

AINSLIE (G. G.). **Notes on Crambids.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 115–119.

More than 100 species of Crambid moths have been recorded from North America, where they cause widespread damage every year. In most cases the food consists of meadow or pasture grass, but 13 species are known to injure field crops. These include:—*Chilo plejadellus* (rice stalk-borer), *Diatraea saccharalis* (sugar-cane borer), *D. zeacolella* (corn stalk-borer), *Crambus caliginosellus*, *C. zeellus*, and *C. luteolellus* (corn and tobacco webworms), *C. hortuellus* (cranberry girdler), *C. mutabilis* (striped webworm), *C. teterrellus* (bluegrass worm), *C. vulgivagellus* and *C. trisectus*. Breeding experiments on various species were begun in the autumn of 1914. Most of the larvae made shelters of silk and grass, but could be easily driven from these for purposes of examination. A number of species were reared from egg to adult stage. The newly-hatched larvae of *C. caliginosellus*, *C. zeellus*, *C. luteolellus*, *C. elegans*, *C. alboclavellus* and *C. laqueatellus* apparently required some special condition, since they refused to feed on any material supplied, whereas older larvae taken in the field and placed in the rearing boxes fed readily on maize. The newly-hatched larvae of *Acrolophus* (*Anaphora*) *popeanellus* fed on partially decayed leaves, but later on preferred fresh food. Some species, including *C. mutabilis*, *C. teterrellus*, *C. praefectellus* and *C. trisectus*, remained active as long as the weather was favourable, and pupated when mature, there being several generations during the year. Others, such as *C. hortuellus*, *C. vulgivagellus*, *C. ruricolellus* and probably *C. laqueatellus*, had one generation, the full-grown larvae remaining in the pupal cell some months before pupating. In the discussion following the paper, it was stated that injury by certain species had occurred in New York, Ohio and Iowa. In Ohio, the larvae of *C. trisectus* were best controlled by the use of tobacco dust. In Iowa, a difference of ten days in ploughing determined whether maize grown on previously infested grass land was destroyed or not.

HAYES (W. P.). **A Study of the Life-History of the Maize Bill-Bug.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 120–130, 1 fig., 3 plates.

The weevil, *Sphenophorus maidis*, Chittn., has been recorded from Alabama, Georgia, South Carolina, Texas, Michigan, Oklahoma, Arkansas and Kansas. The most serious damage to maize occurs in low-lying situations with heavy soils. Means of dispersal are floods, driftwood and probably movements of agricultural supplies. Sugar-cane, sorghum, sweet corn and feterita, in addition to maize, serve as food-plants. Transformation from the pupal to the adult state occurs in the autumn; some of the adults may emerge from the pupal cases and hibernate in the soil, but the majority remain in the cells constructed in the maize stalks until the following April. In 1914, pairing first occurred on 10th May and eggs were deposited 14 days later. Adults usually die at the end of the egg-laying period, that is, between the end of June and the beginning of August, but may survive until late autumn. Eggs are usually deposited in the sheath surrounding the stalk, either above or below the surface of the soil; there is usually one egg in each cavity. Moisture, furnished by the plant tissues, is required for hatching. The average length of the larval stage passed in a burrow in the stalk of maize was about 43 days in 1915. Pupation takes place in cells formed in or near the tap-root; the average length of this stage in 1914 was about 11 days and in 1915 about 14 days. The natural enemies of *S. maidis* are an unidentified Dipterous parasite of the egg and various predaceous insects, such as the adults and larvae of Carabid beetles; the ants, *Monomorium pharaonis*, L., and *Solenopsis molesta*, Say, attacking the larvae; Elaterid larvae, *Lasius niger americana*, Emery (corn field ant), *M. pharaonis* and *S. molesta*, attacking the pupa; adult Carabids and *S. molesta*, attacking the adult. The most satisfactory control measure is to practice rotation of crops; in southern Kansas infested fields are sown with lucerne for several years. Swamp grass in and around infested areas, as well as self-sown maize or sorghum should be destroyed.

In the discussion following the paper, Mr. Z. P. Metcalf stated that in North Carolina there is an autumn flight of the adults of an allied species, *S. callosus*, Oliv.

SCHOENE (W. J.). **The Economic Status of the Seed-Corn Maggot (*Pegomyia fusciceps*, Zett.).**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 131–133.

Chortophila (Pegomyia) fusciceps has hitherto been believed to be injurious to sprouting beans and peas, seed potatoes and the roots of cabbages and onions. Specimens of this insect appear in all collections of *C. brassicae* and are numerous in sweepings of pea-fields and wild mustard. For several years the examination of fields of peas, beans, and potatoes has been carried out in New York, in order to determine, if possible, the actual extent of the damage caused by this species. Very few infested plants were found. In 1911, material for breeding experiments was obtained from the remains of the crop of a cabbage field. Many of the heads were infested with larvae at the points at which new sprouts had arisen. Some of the decayed parts contained

larvae of *C. fusciceps*, while undecayed heads were more or less infested with *C. brassicae*. These facts suggested that *C. fusciceps* is a secondary cabbage pest, attacking plants only after decay has set in, possibly as the result of injury by *C. brassicae*. Certain observers, however, believe that *C. fusciceps* is a primary pest of growing crops; Fletcher states that maize sown during a cold, wet period is very liable to be injured. In the discussion which followed, other evidence was given of the primary importance of the insect. In Michigan and in Canada this fly is very injurious to young bean plants. In south Idaho, in 1914, large areas of beans were completely destroyed, while potatoes following a wheat crop of the previous year were seriously damaged. In Wisconsin it was found hibernating in the pupal stage in onions and was bred from both cabbage and onion. In Kansas, serious cases of infestation were recorded on maize which followed wheat.

SCHOENE (W. J.). **Notes on the Biology of *Pegomyia brassicae*, Bouché.** *Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 136–139.

The spring brood of adults of *Chortophila (Pegomyia) brassicae*, Bch., which emerges from over-wintering pupae, appears first in western New York between 1st and 16th May. Emergence continues for about five weeks. The date of the first appearance may be influenced by the character of the soil, depth of ploughing and slope of the land. Adults maturing in the summer emerge very irregularly, on account of the varying retardation of the developmental stages by conditions of temperature. Experiments showed that between 56° F. and 78° F. there was practically no delay in the transformation of the pupae; when a high temperature was maintained, a few completed development in a few days less than the average period, while the rest remained quiescent. When these retarded individuals were kept at a low temperature, only a few emerged, and many died. A similar retardation of the development of the larvae and pupae of the Hessian fly [*Mayetiola destructor*] is caused by high temperature or severe drought. The number of broods which occur annually is directly connected with delay in development. In western New York there were three effective broods in 1909, while in 1911 only one brood was of any importance.

DEAN (G. A.). **The Hessian Fly Train.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 139–141, 1 plate.

This paper describes the special arrangements made by the Kansas Agricultural College for the purpose of delivering lectures on the habits, etc., of the Hessian fly [*Mayetiola destructor*] throughout the infested regions of Kansas.

GOSSARD (H. A.). **County Coöperation to reduce Hessian Fly Injury.** —*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 142–145.

During the autumn of 1915 efforts were made in Miami County, Ohio, to secure the coöperation of farmers in fixing a date for the sowing of wheat, in order to reduce as far as possible the injury by the Hessian fly [*Mayetiola destructor*]. This was effected by inviting the

personal experience of farmers in this connection, by the organisation of meetings and the publication of the reports of these, and by the activity of the State Entomologist, the County Agent and their assistants. A breeding cage was established and an egg-laying record kept at the Experimental Farm. Sowing was carried out between 1st and 20th October, when conditions in the breeding cages showed that the period of maximum egg production was over. The presence of numerous puparia, developed in self-sown wheat in clover fields, will prevent the crop from being entirely free from fly. Similarly, coöperative sowing in Ohio can only be partly successful in dry years, because of the flies issuing at irregular intervals from the stubble fields which have been sown with clover and cannot be ploughed under.

McConnell (W. R.). **Summary of Facts about the Introduction of *Pleurotropis epigonus*, Walk.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 145–147.

The Chalcid, *Pleurotropis epigonus*, Walk., a parasite of the Hessian fly [*Mayetiola destructor*] was introduced into America from England in 1891. Unsuccessful attempts to breed and liberate the insect were made until 1895, after which date no further records appear to have been made. Breeding experiments were resumed in 1915 at Hagerstown under the direction of the author, nineteen specimens being reared. Adults emerged in cages from April to June and from September to December; oviposition was not observed. In England this species may become abundant during an outbreak of the host and seems able to maintain itself during the intervening periods.

Chapman (J. W.) & Glaser (R. W.). **Further Studies on Wilt of Gipsy Moth Caterpillars.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 149–169, 19 tables.

The investigations described in this paper form a continuation of those carried out during 1913 and 1914 [see this *Review*, Ser. A, iii, p. 356]. The chance method of obtaining healthy experimental material is entirely useless; a stock of caterpillars can be produced by selection in which spontaneous wilt mortality is reduced to a minimum. Wilt is shown to be a true infectious disease. The period between inoculation by feeding and death varied from 13 to 29 days. Wilt seems to be transmitted from one generation to the next through the egg. Certain individuals among the larvae seem to be immune. A new disease appeared in the late stages of larvae reared from foreign eggs, differing clinically and microscopically from wilt. A saccharomycete and a micrococcus were isolated from cases of this disease. The sacbrood disease of bees is not identical with wilt, since polyhedral bodies have never been found in infected insects.

Wellhouse (W.). **Results of Experiments on the Use of Cyanide of Potassium as an Insecticide.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 169–171, 1 plate.

Experiments to determine the effect of potassium cyanide on plant tissues and scale-insects were carried out in Kansas in 1915. Greenhouse plants infested with mealy bugs were treated with the compound,

from 0·5 to 3 milligrams being placed in an incision made in the stem and the aperture closed with paraffin. The tissues around the hole began to turn brown in two or three hours, and two days later the stem was shrunken and bent at this point. No injurious effects on the mealy bugs could be noted. Various trees infested with boring insects were then treated. From 1 to 10 grams of potassium cyanide were placed in holes about ⅜ or ½ inch in depth, and the apertures closed. Examination at different dates showed the wood to be blackened above and below the point of treatment, while a number of living borers were found in elm and plum within a few inches of the place of insertion of the cyanide. The foliage became a darker green after treatment.

HOWARD (L. O.). **On the Hawaiian Work in introducing beneficial Insects.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 172–179.

This paper reviews the work which has been done in Hawaii, with regard to the introduction into that country of beneficial parasites especially those of *Perkinsiella saccharicida*, Kirkaldy (sugar-cane leaf-hopper), *Rhabdocnemis obscurus* (sugar-cane borer), and *Ceratitis capitata* (Mediterranean fruit fly).

HOWARD (L. O.). **Further Notes on *Prospaltella berlesei*, How.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 179–181.

Prospaltella berlesei, How., a parasite of *Aulacaspis pentagona*, has been introduced from Italy and the United States into Uruguay and Argentina, and from the United States into Peru and Chile. Unlike its allies, this parasite seems to be specifically connected with *A. pentagona*, and the opinion is expressed that it is probably of oriental origin, though first discovered in Italy.

PARKER (J. R.). **The Western Wheat Aphis (*Brachycolus tritici*, Gill.).**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 182–187, 1 plate.

Brachycolus tritici has rapidly increased in numbers in some districts of Montana during the past few years and has become one of the most important pests of winter wheat. Leaves of infested plants appear white and fleshy in late autumn and early spring. Heavily infested plants usually die before the following summer, while those less seriously attacked produce a twisted, central stem, bearing curled leaves and a deformed head which usually does not produce seed. *Agropyron occidentale*, Scribn. (blue joint grass) growing near infested wheat fields is usually severely injured. This grass may be the native host plant, but the Aphid has not been found upon it when growing at some distance from infested grain. Barley may also be attacked, as well as *Bromus secalinus*, L., *Stipa comata*, F. and R., and *Phleum pratense*, L., when growing near wheat.

The winter is passed in the egg-stage upon autumn-sown wheat, self-sown wheat, and grasses. The stem-mothers, hatching early in

April, produce young in about two weeks. Winged migrants are abundant by 15th June, continue to increase until 1st July, then decrease and finally disappear by 15th August. The migrants settle on small self-grown grain or grass plants, where they feed until the new crop of autumn wheat is sufficiently developed. Sexual forms appear about 15th October, and egg-laying continues until late in November. The most efficient method of control is the clean cultivation of summer-fallowed wheat land. In Montana it is usual to plough such land in spring and to follow ploughing by a number of diskings to destroy vegetation. Frequent diskings are not desirable in the most heavily infested districts of Montana, because of the pulverisation of the soil and subsequent drifting. A hand hoe is used by some growers to destroy plants which have escaped the first diskings. Late ploughing is recommended in districts where the Aphid is abundant. Injury is also reduced by allowing sheep to graze over summer-fallowed land. Infested fields may be sown with oats, a crop which is never attacked by this Aphid.

McCray (A. H.). **Some Difficulties in Gross Diagnosis of the Infectious Brood Diseases of Bees.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 192–196.

The diagnosis of brood diseases in bees is based almost exclusively on the examination of dead larvae. The appearances resulting from each of the three known infectious brood diseases may vary considerably in different cases; hence rough diagnosis is sometimes impossible and must be supplemented by microscopical examination. Odour is of value only in American foulbrood, and then in certain cases may be slight or even absent. Colouration is not constant in either American or European foulbrood; where young larvae are affected, the colour of the American type is closely similar to that of the European form. The consistency of the broken down larval mass is one of the most constant factors, but this also is subject to variations. The scales of affected larvae are so characteristic in the case of American foulbrood that a positive diagnosis of the disease in this stage can almost invariably be made; this, however, is not possible in the case of the European foulbrood. Sacbrood should be readily diagnosed from the distended condition and watery content of the larva.

Pettit (M.). **Outline of Apiary Inspection in Ontario.**—*Jl. Econ. Entom., Concord,* ix, no. 1, February 1916, pp. 196–199.

Beekeepers are required to report the existence of foulbrood to the Minister of Agriculture. Inspection begins about 24th May and is continued as long as possible. With American foulbrood, the district is worked over thoroughly, but with European foulbrood, the ground is seldom covered a second time. In June 1915 visits were made to 391 apiaries in the European foulbrood districts, and in these 1,387 out of 5,367 colonies were diseased. In the American foulbrood districts 921 out of 10,825 colonies were affected.

SANDERS (J. G.). **A Model State Horticultural Inspection Law.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 206–212.

In this paper a further appeal is made for greater uniformity in the legislation of the various States for regulating the inspection and transportation of nursery stock and horticultural inspection generally. The draft of a bill providing for such inspection is given.

WEISS (H. B.). **Foreign Pests recently established in New Jersey.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 212–216.

The following is a list of insects introduced in New Jersey, mainly on nursery stock, during the past two years:—

Lepidoptera. From Belgium: *Gracilaria zachrysa*, Meyr., on azaleas. From Holland: *Rhyacionia* (*Evetria*) *buoliana*, Schiff., on pines.

Orthoptera. From Holland or Belgium: *Gryllotalpa gryllotalpa*, L. (European mole cricket), in soil around the roots of plants.

Coleoptera. *Otiorrhynchus sulcatus*, F., on rhodendrons; *Agrilus viridis*, L. var. *fagi*, Ratz., on roses; *Myelophilus piniperda*, L., on Scotch pine; *Plagiodera versicolor*, Laich., on poplar and willow. From Central America or the State of Colombia: *Eucactophagus graphipterus*, Champ., in orchids.

Diptera. From Holland: *Phytomyza aquifolii*, Gour., on holly, *Merodon equestris*, L., in bulbs, and *Monarthropalpus buxi*, Lab., on boxwood.

Rhynchota. From Japan: *Antonina crawi*, Ckll. (cottony bamboo scale), on bamboo; *Leucaspis bambusae*, Kuw., on bamboo; *Aspidiotus tsugae*, Marl., on Japanese hemlock; and *Pseudococcus kraunhiae*, Kuw., on *Taxus cuspidata brevifolia*. From Brazil and Venezuela: *Targionia biformis*, Ckll., on orchids. From Guatemala: *Chrysomphalus perseae*, Comst., on orchids. From the Philippines: *C. rossi*, Mask., on orchids. From Belgium: *Aleurodes* sp., on azaleas. From Japan, the Tingitid, *Stephanitis azaleae*, Horv., on azaleas.

SASSCER (E. R.). **Important Foreign Insect Pests collected on Imported Nursery Stock in 1915.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 216–219.

The following insects were collected on imported nursery stock during 1915:—

From Holland: *Lymantria* (*Porthetria*) *dispar*, L. (gipsy moth), on blue spruce; *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (European pine-shoot moth), on *Pinus mughus* and *P. montana*; *R.* (*E.*) *resinella*, on *P. mughus*; *Orgyia* (*Notolophus*) *antiqua*, L. (vapourer moth), on various stock; cocoons of an undetermined sawfly on spruce; *Pseudaonidia paeoniae*, Ckll., on azalea. From France: *Euproctis chrysorrhoea*, L. (brown-tail moth); *O. antiqua*, L.; *Apatela auricoma*, F.; *Emphytus cinctus*, L., on roses; *Epidiaspis piricola*, Del. G. (European pear scale), on pear seedlings. From England and Denmark: *O. antiqua*, L., on various stock. From Peru: A weevil, *Tripopremnon* sp., in potatoes. From Colombia: *Tenthrecoris bicolor*, Scott, on orchids. From Venezuela: *T. bicolor*, *Chrysomphalus perseae*,

Comst., and *Targionia biformis*, Ckll., on orchids. From the Philippine Islands: *Cosmopolites* (*Sphenophorus*) *sordidus*, Germ., and *Polytes mellerborgi*, Boh. (*Calandra remota*, Sharp), on bananas; *Pseudaonidia articulatus*, Morg., and *Parlatoria ziziphus*, Lucas, on citrus cuttings. From Brazil: *Aonidia* sp., on *Myrciaria edulis*; *T. biformis* on orchids. From British Honduras: *Aspidiotus palmae*, Morg. and Ckll., and *Pinnaspis buxi*, Bch., on coconut. From Japan: *Pseudaonidia paeoniae*, on azalea; *Chionaspis wistariae*, Cooley, on wistaria; *Lepidosaphes newsteadi*, Sulc., on *Sciadopitys verticillata*; *Leucaspis bambusae* on bamboo; *Parlatoria theae*, Ckll., on maple and *Pseudococcus azaleae*, Tins., on azalea. From Java: *Chionaspis tegalensis*, Zehnt., on sugar-cane. From China: *Phenacaspis eugeniae*, Mask., on ornamental plants.

Several insects, including *Forficula auricularia*, L. (European earwig), *Gryllotalpa gryllotalpa*, L. (European mole-cricket), and larvae of *Lachnosterna* and Elaterids, have been introduced in the soil around the roots of azaleas, rhododendrons, etc. The question therefore arises as to whether such stock can be forwarded without soil round the roots, or if not, whether the soil pests can be eliminated at the port of entry by fumigation in a partial vacuum with hydrocyanic acid gas.

SASSCER (E. R.). **Inspection Facilities in the District of Columbia.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 219–223, 3 plates.

Arrangements for the inspection of nursery stock imported into the District of Columbia have been rendered more effective by the recent installation of new equipment. A description is given of the method of inspection, the new inspection house and the apparatus used for fumigating plants, etc.

O'BYRNE (F. M.). **Nursery Inspection in Florida.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 224–226.

The system of nursery inspection in Florida aims at obtaining an accurate record of the movement of all nursery stock imported into or exported from the State. Should a new disease or insect pest appear in any locality, the point of origin of the stock can thus be traced. The disinfection of the clothes and implements used by inspectors is strictly carried out.

SHAW (N. E.). **The Ohio Inspection System.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 227–231.

The Ohio Inspection Law provides for the annual inspection of nurseries, with additional inspections if required. Stocks showing infestation by San José scale [*Aspidiotus perniciosus*] are destroyed by burning, subject to the consent of the owner. Should the latter object, he is allowed to apply such treatment as may be ordered. Summer treatment of nursery blocks is not recommended, except in

extreme cases. In cases of slight infestation, the removal of trees and the fumigating system are used. An extensive campaign is being carried out against this pest which is well-established over about three-quarters of the State.

ALLEN (H. W.). **Notes on the Relation of Insects to the Spread of the Wilt Disease.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 233–235.

Preliminary experiments on the carriage of polyhedra of wilt disease by insects were performed during 1915 at Lunenburg, Mass. The following insects were collected while feeding on, or in contact with, larvae and pupae of the gipsy moth [*Lymantria dispar*] which had died of wilt:—Sarcophagid flies, *Calosoma sycophanta*, adult Elaterids and Coccinellids, an unknown Hemipteron, and red mites. Sarcophagid flies were especially abundant, and they and the other insects mentioned were found to carry polyhedra on the feet and mouth-parts. This suggests that insects found in association with the disease, and which carry polyhedra after contact with it, may assist in spreading the infection.

COCKERELL (T. D. A.). **Two New Monophlebine Coccidae from the Philippine Islands.**—*Jl. Econ. Entom., Concord*, ix, no. 1, February 1916, pp. 235–236.

The new species described are:—*Llaveia benguetensis* and *Drosoicha palavanica*.

GRASSI (B.). **Di una malattia infettiva della** *Diaspis pentagona*, **Targ.** [On an infectious disease of *Aulacaspis pentagona*, Targ.]—Separate from *Boll. Informazioni Seriche*, ii, no. 19, 1915, 6 pp.

In order to determine precisely the efficiency of *Prospaltella berlesei* in controlling *Aulacaspis pentagona* it is necessary to distinguish its action from that of an infectious epidemic disease which attacks the scale very actively and is far more destructive than *Prospaltella* [see this *Review*, Ser. A, iv, p. 15]. Cases are instanced where 60 per cent. of the Coccids were killed by the infection. The infected adult scales are less markedly red than those parasitised by the Hymenopteron, and are swollen and soft, as if filled with liquid; they never contain eggs. Individuals killed by the disease are very dark in colour, like those which have died a natural death, but differ from them in being longer than wide and flattened out. At present nothing can be said as to the possibility of artificially transmitting this infection. In combating *A. pentagona*, *P. berlesei* is certainly slower than *Novius cardinalis* against *Icerya purchasi*, but it is assisted by this disease. While the diffusion of *Prospaltella* should be furthered, efforts should also be made to develop the disease in localities where it does not manifest itself spontaneously, while other enemies, especially predaceous Coccinellids such as *C. bipustulatus* and *Rhyzobius lophantae*, should be given all possible assistance.

BONDAR (G.). **Insectos damninhos á agricultura. Fasciculo iii—Pragas das Laranjeiras e outras Auranciaceas.** [Insects injurious to agriculture. Part iii—Pests of orange trees and other Aurantiaceae.]—*S. Paulo (Brazil)*, 1915, 47 pp., 27 figs. [Received 27th March 1916.]

The information here given regarding the citrus borers, the Longicorns, *Acrocinus accentifer*, Ol., and *Diploschema rotundicolle*, Serv., and the weevil, *Cratosomus reidi*, Kirby, is practically the same as that in a previous paper [see this *Review*, Ser. A, ii, p. 173]. Besides beetle-borers, the caterpillar of an undetermined butterfly was, on one occasion, observed mining the branch of a young orange tree, in which it made a somewhat spiral gallery. In March and April apparently ripe oranges were found on the ground, infested by the caterpillar of *Tortrix citrana*, Fern. (orange tortrix), here observed for the first time, though it is well-known in California. A minute hole is made in the fruit, usually in the lower portion, and the insect enters, its presence being revealed by the expelled excreta which cover the orifice. The caterpillar grows and bores into the orange, which ripens and falls. In most cases the caterpillar carries the spores of the fungus, *Aspergillus penicillium*, with which it infects the fruit. When full-grown, the caterpillars pupate among dried leaves in cavities of the trunk; the moth emerges in three weeks. The collection and destruction by burying of all infested fruit, whether lying on the ground or on the tree, is the best method of control. The caterpillar of *Papilio idaeus*, F., also feeds on the leaves of citrus plants. When the caterpillars are young, kerosene-soap emulsion gives good results; when they are larger, they may easily be collected by hand. Some Limacodids which injure citrus trees are abundant in orchards. One species of the genus *Eurida* is recorded as attacking oranges.

Of the 169 species of Coccids recorded in Brazil, 22 were observed on Aurantiaceae. Those most frequently noticed were:—*Hemichionaspis aspidistrae*, Sign., *Chrysomphalus (Aspidiotus) aonidum*, L., and *Lepidosaphes beckii*, Newm. (*Mytilaspis citricola*, Pack.). Less common species were:—*Howardia biclavis*, Comst., *Chionaspis citri*, Comst., *Hemichionaspis minor*, Mask., *Aspidiotus cydoniae*, Comst., *A. rapax*, Comst., *Pseudaonidia trilobitiformis*, Green, *Selenaspidus articulatus*, Morg., *Chrysomphalus personatus*, Comst., *C. scutiformis*, Comst., *C. aurantii*, Mask., *Parlatoria proteus*, Curtis, *Ceroplastes floridensis*, Comst., *Coccus hesperidum*, L., *C. viridis*, Green, *Saissetia hemisphaerica*, Targ., *S. oleae*, Bern., *Pseudococcus citri*, Risso, *Orthezia insignis*, Dougl., and *O. praelonga*, Dougl. The usual measures against Coccids are advised. A bibliography of ten works closes this paper.

Osservatorio Autonomo di Fitopatologia, Turin, Mthly. Leaflets, nos. 1–12, January 1915, 48 pp. [Received 30th March 1916.]

These leaflets for 1915 are on the same lines as those for the preceding year [see this *Review*, Ser. A, iii, p. 123]. The following is a brief record of the injurious insects:—*Hylesinus fraxini*, on cherry; *Aulacaspis pentagona* on *Euonymus*, cherry, mulberry, poplar and walnut; *Eulecanium (Lecanium) persicae* and *Aspidiotus nerii*, on oleander; *Eriosoma (Schizoneura) lanigerum*, *Magdalis ruficornis*,

(C268) Wt. P1/106. 1,500. 6.16. B.& F.Ltd. Gp.11/3. A

Eucosma (*Tmetocera*) *ocellana*, *Cossus cossus* and *Zeuzera pyrina* (*aesculi*) on apple; *Coraebus undatus* and *Lepidosaphes ulmi* (*Mytilaspis pomorum*) on *Diospyros kaki* ("nespolo"); *Euproctis* (*Porthesia*) *chrysorrhoea*, *Tetraneura ulmi*, and *Tetranychus telarius* on elm; *Cnethocampa pityocampa*, and *Dendrolimus pini* on pine; *Lucanus cervus*, *Aegeria* (*Sesia*) *asiliformis*, *Hylotrupes bajulus*, *Byctiscus betulae* (*Rhynchites betuleti*), *Aulacaspis pentagona* and *Trochilium apiforme* on poplar; *Aulacaspis* (*Diaspis*) *rosae* on roses; *Chionaspis salicis*, *Rhabdophaga saliciperda*, *Pontania salicis* and *Lepidosaphes ulmi* on willow; *Ceuthorrhynchus sulcicollis*, *C. pleurostigma* and *Pieris brassicae* on cabbage; *Agriotes lineatus* on maize; *Coccus* (*Lecanium*) *hesperidum* on ivy; *Icerya purchasi* and *Ceroplastes sinensis*, on lemon; *Epidiaspis* (*Diaspis*) *pyricola*, *Contarinia pyrivora*, *Eriophyes* (*Phytoptus*) *pyri* and *L. ulmi* on pears; *Acidia heraclei* on celery, *Eulecanium* (*Lecanium*) *coryli*, *Oberea linearis*, and *Balaninus nucum* on hazel; *Aspidiotus hederae* (*nerii*) on palms; *Phloeosinus thujae* on thuja; *Crioceris asparagi* and *Platyparea* (*Tripeta*) *poeciloptera* on asparagus; *Helops quisquilius* on various greenstuffs; *Monarthopalpus buxi* on box; *Hyalopterus arundinis* (*pruni*) on peach; *Acrolepia assectella* on onion; *Polychrosis botrana*, *Clysia ambiguella*, *Eriophyes* (*Phytoptus*) *vitis*, *Aulacaspis pentagona* and *Eulecanium* (*Lecanium*) *persicae* on grape vines; *Gryllotalpa gryllotalpa* attacking chrysanthemums; *Melolontha melolontha* on geranium and dahlia; *Cheimatobia brumata* on lime trees; *Cephus pygmaeus* on wheat; *Cydia* (*Grapholitha*) *dorsana* on peas; *Cydia* (*Carpocapsa*) *splendana* on walnut; *Lithocolletis platani* on plane; *Tetranychus telarius* on *Robinia* and linden; *Hyponomeuta padellus* on plum; *Pegomyia hyoscyami* (*Anthomyia conformis*) on beet; *Heterodera radicicola*, Greef., on carrot; *Chionaspis euonymi* on *Euonymus*; *Hemerophila* (*Simaethis*) *nemorana*, Hb., on fig; and *Zeuzera pyrina* in horse-chestnut and beech.

MALENOTTI (E.). **Specie nuove e critiche di Diaspiti.** [Notes on Diaspids and description of two new species.]—Separate, dated 24th March 1916, from *Redia, Florence*, xi, no. 2, pp. 309-320, 1 plate.

Adiscodiaspis tamaricicola, sp. n., on *Tamarix* sp. in Egypt, and *Chrysomphalus calami*, sp. n., on *Calamus spectabilis* in Sumatra, are described. Descriptive notes are given of *Hemiberlesia ephedrarum*, Ldgr., on *Ephedra nebrodensis* and *E. scoparia* in Spain and Sardinia; *H. trabuti*, March., on *E. nebrodensis* in Sardinia; and *Epidiaspis gennadiosi*, Ldgr. (*Diaspis gennadii*, Leon.), from Athens on an undetermined plant.

MALENOTTI (E.). **Diaspiti raccolté nella Somalia italiana meridionale.** [Diaspinae collected in South Italian Somaliland.]—Separate, dated 24th March 1916, from *Redia, Florence*, xi, no. 2, pp. 321–358, 2 plates.

This paper deals with scale-insects collected by the Stefanini-Paoli Mission in south Italian Somaliland in 1913, mostly from near the mouth of the Juba River, and is believed to be the first attempt to deal with the COCCIDAE of that region.

They include :—*Aspidiotus destructor*, Sign., on the leaves of *Cocos nucifera* at Merka, many individuals being parasitised by a Chalcid; a species of *Aspidiotus* which the author believes to be intermediate between *A. destructor*, Sign., and *A. transparens*, Green [see this *Review*, Ser. A, iii, p. 548] on *Xylocarpus obovatus*; *A. cyanophylli*, Sign., on leaves of *Manihot glaziovii*; *A. orientalis*, Newst., on the fruits of *Calotropis procera* and *Solanum arundo* at Mogador, many individuals being attacked by an undetermined Chalcid; *Chrysomphalus rossi*, Mask. var. *ferandii*, var. n., on the leaves of *Garcinia somalensis*; *Chrysomphalus piceus*, sp. n., abundant on *Cassine schweinfurthiana* ?; *Pseudaonidia quadriareolata*, sp. n., on the bark of *Acacia asak*, together with *Lepidosaphes somalensis*, sp. n.; *Selenaspidus articulatus*, Morg., on *Salvadora persica* and *Xylocarpus obovatus*; *Hemiberlesia fissidens*, Ldgr. var. *constricta* var. n., on *Rhizophora mucronata*, together with *Chionaspis pseudo-nivea*, sp. n., on the leaves of a Doum palm, *Hyphaene pyrifera*; *Parlatoria blanchardi*, Targ., on date palms at Merka; *Dinaspis reticulata*, sp. n., on *Dobera macalusoi*, and on an undetermined plant; *Dinaspis reticulata*, var. *minor* var. n., on *Balanites somalensis*; *Dinaspis berlesei*, sp. n., on ? *Cadaba* sp.; *Chionaspis usambarica*, Ldgr., on *Xylocarpus obovatus*; *Chionaspis elongata*, Green, on *Cassine holstii*; and *Chionaspis paolii*, sp. n., on *Mariscus chaetophyllus*.

The author considers *Aspidiotus translucens*, Ckll., to be a synonym of *A. destructor*, Sign., and *Chrysomphalus pedroniformis*, Ckll., to be synonymous with *Asp. orientalis*, Newst.

Ballou (H. A.). **Insects in the Virgin Islands.**—*Agric. News, Barbados*, xv, no. 361, 26th February 1916, pp. 74–75.

In the Virgin Islands, *Batocera rubus*, L., which is also known to occur in St. Croix, St. Thomas, and Tortola, as well as in Trinidad, India, Ceylon, Borneo, Mauritius, etc., attacks mango, avocado, papaw, banana, *Ficus elastica*, hog-plum, and *Ochroma lagopus*. The adult beetles deposit eggs on or beneath the bark of the host, and the larvae either tunnel beneath the bark or bore into the interior. The larvae also appear to be able to feed on decaying wood. Those found in infested trees should be destroyed by probing or should be cut out. Logs of trees known to be host plants may be used as traps for ovipositing females, or adults may be collected by hand.

Larvae of *Strategus titanus* (rhinoceros beetle) have been a serious pest of sugar-cane in St. Croix. Cotton flower-buds contained an unidentified Cecidomyiid larva. In Antigua, the same insect causes the buds to drop. *Diaprepes abbreviatus* (root borer weevil) and *Lachnopus curvipes* attack lime trees, citrus, bay trees, and cotton. The larvae of a Noctuid moth, probably *Prodenia latifascia*, Walk. (*commelinae*, Druce), also occurs. This species is a common pest of onions in certain situations in the West Indies.

Marcovitch (S.). **The Red Rose Beetle.**—*Office of State Entomologist, St. Anthony Park, Minn.* Circ. no. 36, 30th January 1916, 4 pp., 6 figs. [Received 23rd March 1916.]

Rhynchites bicolor, F. (red rose beetle or rose curculio) injures Japanese roses in early summer in Minnesota by puncturing the

flower buds and stems. In the white variety, *Rosa rugosa alba*, larvae were found in a half-grown state within the flowers on 22nd July. Adults were first observed puncturing the buds on 10th June; on 28th June, eggs were found deposited within the hips about 1 or 2 mm. below the surface. The eggs hatch in from six to ten days, and the larvae at once bore into the seeds. Egg-laying punctures can be distinguished from feeding places in that they are blackish and covered over. Two or three larvae are usually present in each hip, and reach maturity about the middle of September. They then enter the soil and pupate in the following spring.

Methods of control include hand-picking the infested hips early in August, cultivation round the bushes in late autumn and early spring, spraying the adults with lead arsenate, and in the case of *R. rugosa alba*, hand-picking the dried flower-buds before 1st August.

LEONARD (M. D.). **The Immature Stages of *Tropidosteptes cardinalis*, Uhler (Capsidae, Hemiptera).**—*Psyche, Boston, Mass.*, xxiii, no. 1, February 1916, pp. 1-3, 1 plate.

Adults of *Tropidosteptes cardinalis* were first observed on the leaves of ash near Cornell Insectary in June 1908. Injury resulted in the formation of yellow spots on the foliage and in severe cases the leaves became crumpled up. Observations on the immature stages were made during 1914 and 1915. First-stage nymphs were found on 23rd May, and fifth-stage nymphs on 4th June. The winter is passed in the egg-stage; the eggs are probably inserted during late summer into the smaller twigs. A description of the nymphal and adult stages is given.

WEISS (H. B.). **The Coccidae of New Jersey Greenhouses.**—*Psyche, Boston, Mass.*, xxiii, no. 1, February 1916, pp. 22-24.

This list includes:—*Icerya purchasi*, Mask., on acacia, orange and lemon; *Orthezia insignis*, Dougl., on coleus, gardenia, verbena, citrus, chrysanthemum, tomato, etc.; *Pseudococcus citri*, Risso, on coleus, citrus, ferns, fuschia, tomato, geranium, etc.; *P. adonidum* (*longispinus*, Targ.) on ferns, citrus, palms, dracaena, etc.; *P. pseudonipae*, Ckll., on *Kentia* and *Cocos*; *Ceroplastes cirripediformis*, Comst., on citrus; *C. floridensis* Comst., on citrus and oleander; *Eucalymnatus tessellatus*, Sign., on palms; *Coccus hesperidum*, L., on bay trees, oleander, begonias, palms, orchids, etc.; *C. longulus*, Dougl., on citrus, ficus, euphorbia, and ferns; *C. pseudohesperidum*, Ckll., on orchids; *Saissetia hemisphaerica*, Targ., on palms, ferns, oleander, orchids, citrus, etc.; *S. oleae*, Bern., on camellia and citrus; *Diaspis boisduvalii*, Sign., on palms and orchids; *D. bromeliae*, Kern., on pineapple, latania, etc.; *D.* (*Aulacaspis*) *zamiae*, Morg., on *Cycas revoluta*; *Hemichionaspis aspidistrae*, Sign., on ferns, aspidistra, pandanus, and orchids; *Fiorinia fioriniae*, Targ., on camellia, palms, figs, and orchids; *Aspidiotus britannicus*, Newst., on bay trees; *A. cyanophylli*, Sign., on palms, orchids and ficus; *A. hederae*, Vall., on orchids, palms, cycads, ivy, citrus, etc.; *A. rapax*, Comst., on bay trees, palms, and camellia; *Chrysomphalus aonidum*, L., on palm, pandanus, ficus, citrus, etc.; *C. aurantii*, Mask., on citrus, palms, and

pandanus; *C. dictyospermi*, Morg., on palms, pandanus, and latania; *C. perseae*, Comst., on orchids; *C. rossi*, Mask., on orchids; *Targionia biformis*, Ckll., on orchids; *Lepidosaphes beckii*, Newm., on citrus and croton; *L. gloveri*, Pack., on palms and citrus; *Ischnaspis longirostris*, Sign., on palms and pandanus; *Parlatoria pergandii*, Comst., on citrus.

STERRETT (W. D.). **The Ashes: Their Characteristics and Management.** —*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 299, 13th December 1915, 88 pp., 16 plates, 1 map, 49 tables. [Received 30th March 1916.]

This paper deals with the cultivation of the ash on a commercial scale. The insect pests of this tree include:—*Lepidosaphes ulmi* (oyster-shell scale), which is the most serious pest of standing timber in northern Ohio. Trees which have been recently felled are attacked by a bark beetle, *Hylesinus aculeatus*, *Platypus* sp., and *Xyleborus* sp. (ambrosia beetles), *Neoclytus caprea* (round-headed borer), and powder-post borers, the last-named injuring the sapwood. Losses of logs and timber through insects can be nearly eliminated by rapid conversion of the felled tree into lumber and by proper methods of handling and storing.

BAKER (A. C.). **Identity of** *Eriosoma pyri*.—*Jl. of Agric. Research, Washington, D.C.*, v, no. 23, 6th March 1916, pp. 1115–1119.

In this paper it is stated that *Eriosoma pyri*, the woolly aphis described by Fitch from the roots of apple, is distinct from *E. lanigerum*, Hausm. (the woolly apple aphis). A description of *E.* (*Prociphilus*) *pyri*, Fitch, is given, together with descriptions of several allied species of *Prociphilus*.

LIZER (C.). **Une nouvelle variété de Discolomide (Col.) de l'Amérique méridionale:** *Coccidophilus citricola*, **Brèth. v. nov.** *rufus*. [A new variety of Discolomid (Col.) from South America.]—*Physis, Buenos Aires*, ii, no. 9, 10th November 1915, p. 43. [Received 22nd March 1916.]

Several examples of this new variety of *Coccidophilus citricola*, have been found on a peach tree infested by *Aulacaspis pentagona*, Targ., near Buenos Aires.

LIZER (C.). **Un cóccido asiático nuevo para la República Argentina,** *Chrysomphalus dictyospermi pinnulifera*, **Mask. (Hem. Hom.).** [An Asiatic Coccid new to the Argentine.]—*Physis, Buenos Aires*, ii, no. 10, 12th February 1916, p. 177.

The citrus scale, *Chrysomphalus dictyospermi* var. *pinnulifera*, Mask., has been found on oranges near Buenos Aires, as well as on *Citrus limonium*, Ris., *Vitis vinifera*, L., *Laurus nobilis*, L. and on some ornamental plants. Although it has not been reported before, it must have been introduced some time previously, as the infested area extends as far as Corrientes.

Martelli (G.). Intorno a due specie di Lepidotteri dei generi *Zelleria* **e** *Glyphodes* **viventi sull' olivo.** [Concerning two species of Lepidoptera of the genera *Zelleria* and *Glyphodes* living on the olive.] —Separate, dated 2nd March 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, x, pp. 89–102.

Both *Zelleria oleastrella*, Mill., and *Glyphodes unionalis*, Hb., are found on the olive in south Italy; *Z. oleastrella* has at least five generations from April to December, the complete life-cycle requiring from four to six weeks in favourable seasons. The adult appears in March-April, is crepuscular in habit and feeds on sugary substances in the flowers of the olive and on the leaves, where they are mixed with the sweetish excrement of *Saissetia oleae*, Bern., and *Filippia oleae*, Costa. The larva attacks the tender leaves of the buds and either penetrates into the growing tip and devours it internally or remains on the upper surface of a leaf, weaving a few threads around it. It is capable of rapid movement, in which it resembles *Clysia ambiguella*. The larva is injurious in the case of young plants not only on account of damage to the foliage, but because an attack on the bud-tip of the leading shoot causes the plant to develop in an abnormal shape. A 1 per cent. solution of arsenate of lead paste sprayed twice, at a 10-day interval, is an efficient remedy. Among the Dipterous parasites of this pest are the Tachinid, *Phytomyptera nitidiventris unicolor*, Rond.; it is also attacked by various parasitic Hymenoptera, including *Apanteles* sp., *Angitia* sp. and *Ageniaspis fuscicollis*.

Glyphodes unionalis, Hb., appears in the adult stage in March and April and is seen flying round olive branches with new growth. It feeds on sugary substances, sweet excreta of Coccids and nectar. Its eggs are deposited on either surface of the olive leaf or on the green twigs. The larva hatches in from three to twenty-five days, according to the season in south Italy. It attacks the tender leaves at the tip of the twig after first weaving a few threads round the leaf so as to cause it to assume a tubular form and remains in this tube until the first moult is completed. This moth appears to have at least five generations a year, the life-cycle varying from 36 to 82 days. It usually attacks the leaves of the suckers and is beneficial in this case, but when young plants and new buds are attacked it is injurious in the same way as the preceding species, and the same spray should be used as a control. The Tachinid, *Nemorilla notabilis*, Meig., and a Braconid, *Apanteles* sp., are parasites of it.

Важнѣйшія сельско-хозяйственныя мѣропріятія за 1914 годъ. [The chief agricultural measures in 1914.]—**« Извѣстія Министерства Земледѣлія.»** [*Bulletins of the Ministry of Agriculture*], *Petrograd*, nos. 51 & 52, 2nd & 15th January 1916, pp. 1253–1257 & 1269–1273. [Received 6th April 1916.]

This is a short summary of the last yearly report of the Ministry of Agriculture. Notwithstanding the war, all the scientific research work as to the control of insect pests in various parts of the country was successfully carried out. The Department of Agriculture came, as in previous years, to the assistance of the local organizations in importing various insecticides duty-free from abroad and there were

imported, in this way, about 28 tons of Paris green, about 16 tons of copper sulphate, some 27 tons of carbon bisulphide and about 15 tons of sodium arsenate. The Bureau of Entomology in Petrograd has continued its studies on pests of Leguminosae and of cotton-seed in Turkestan and Fergana.

VASSILIEV (Eug. M.). **Отчетъ о дѣятельности Энтомологическаго Отдѣленія Мико-Энтомологической Опытной Станціи Всероссійскаго Общества Сахарозаводчиковъ въ м. Смѣлѣ (Кіевской губ.) за 1915 годъ.** [Report of the work of the Entomological Department of the Myco-Entomological Experimental Station of the All-Russian Society of Sugar-refiners in Smiela (govt. of Kiev) for 1915], *Kiev*, 1916, 49 pp. [Received 7th April 1916.]

This is a series of articles and reports by several authors, of which Professor E. M. Vassiliev is the Editor.

Bothynoderes punctiventris, Germ., has decreased during the last three years and in the year under report no measures were taken for its control.

BOGOYAVLENSKY (S. G.). *Tanymecus palliatus*, F., pp. 6–23, 8 figs.

The Editor remarks that this pest of the subfamily TANYMECINAE is widely spread in Western Europe and in Russia, where it has been very common during the last three years and the author was entrusted with the investigations on its biology. Of the beetles found in the trap trenches, *T. palliatus* constituted 70 per cent., and it is thought that the increase in their numbers is related to the decrease in those of *Bothynoderes punctiventris*. The beetles appear during the first half of April on sugar-beets and also other plants, including *Urtica*, *Chenopodium album*, *Beta vulgaris*, *Soja hispida*, peas, clover, vetches, chicory, sorrel, *Sisymbrium*, poppy, potatoes, *Lamium purpureum*, L. (dead-nettle), maize, onions and garlic, although it is uncertain whether all of these actually serve as food. Considerable damage is done to the foliage of the food-plant. Pairing begins soon after the appearance of the beetles in spring and is repeated during the oviposition period, which lasts for two to three months. In nature the eggs are probably chiefly deposited in the soil near the base of the plants. The egg-stage lasts from 14 to 29 days, according to the season. The larvae, which are figured and described, moult at intervals of two weeks. The investigations have not been completed, and it is uncertain whether they live more than one year or whether they injure the roots of beet.

BOGOYAVLENSKY (S. G.). *Alophus triguttatus*, F., pp. 23–25, 1 fig.

The Editor points out that this insect was first found in trap-trenches in 1906 by Prof. V. Pospielov and that its eggs and larvae were unknown. The author has now been able to obtain and describe both. The development of the egg in May lasts about 27 days.

BOGOYAVLENSKAIA (M. G.). *Melanotus brunnipes*, Germ., pp. 25-28, 3 figs.

The author describes some observations made in the laboratory on eggs and larvae of this insect. The larvae fed preferably on carrots, and also on beet and potatoes.

BOGOYAVLENSKY (S. G.). *Bibio marci*, L. and *B. hortulanus*, L., pp. 28-37, 4 figs.

B. marci was on the wing during the first half of May, at the end of which period only males were present, the females having evidently entered the earth to oviposit. *B. hortulanus* was on the wing during the whole of June, both sexes being present during the whole time. Both species oviposit in the soil in heaps, the females usually perishing after that process; 1,405 eggs were counted in one heap laid by *B. hortulanus*.

KOSTINSKY (V. M.). *Pyrausta nubilalis*, Hb., pp. 37-44, 6 figs.

This insect has done great damage to maize on one estate. The caterpillars were infested with Hymenopterous and Dipterous parasites, and were found during May and the first half of June; the pupal stage lasted from 12 to 16 days, the first imago appearing on 18th-21st June. Observations in the laboratory on the imago have shown that each female may lay 500-600 eggs; the egg-stage lasted five or six days, and the whole cycle from egg to imago 50-57 days. A second generation may occur which oviposits in August and produces caterpillars in the same month. No eggs laid in August were found in nature.

BOGOYAVLENSKAIA (M. G.). *Haltica oleracea*, pp. 44-49, 4 figs.

During the author's observations on this insect in 1914 [see this *Review*, Ser. A, iii, p. 538] no males were found; in 1915 out of 600 specimens only four were males. The collections of D. A. Ogloblin in the government of Poltava showed even a smaller percentage of males (1 in 360). This beetle has two, sometimes three generations in one summer; the adults of the first generation are present in May and those of the second in July. To the food-plants given in the last report, must be added *Glycyrrhiza glabra*, according to N. Sacharov, and *Cirsium* sp., according to A. Goriainov; cabbage again proved not to be a food-plant of this insect.

PERESSYPKIN (P.). **Передвижные летучіе отряды по борьбѣ съ вредителями садовъ.** [Travelling detachments for the control of pests of orchards.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, no. 10, 19th March 1916, pp. 289-292.

The Zemstvo of Voronezh organised in 1912 and 1913 detachments of travelling instructors, each consisting of three men, to travel about and instruct the population by practical demonstrations in methods of plant cultivation, pest control, etc. The organisation of such detachments elsewhere is urged.

ROGOZIN (A.). **Окуриваніе сѣрой.** [Fumigation with sulphur.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, no. 10, 19th March 1916, p. 310.

The author suggests the use of the sulphur-paper ribbons used by the military sanitary authorities in their campaign against parasites of man, for controlling plant pests. These consist of slips of ordinary newspaper soaked in sulphur melted on a slow fire; they are easily prepared, burn without any waste, and can be suspended inside the crown of the trees, so that the whole volume of vapour produced will be utilised.

PLOTNIKOV (V.). **Отчеты о дѣятельности Туркестанской Энтомологической Станціи за 1912, 1913 и частью 1915 гг.** [Reports on the work of the Turkestan Entomological Station in 1912, 1913, 1914 and part of 1915.]—*Tashkent*, 1915, 60 pp. [Received 7th April 1916.]

This series of reports covers the period from 1912, being the second year of the existence of the station, to 1915, and describes the general and scientific research work done by the staff in each year.

The following orchard pests were reported in 1912: *Polyphylla tridentata*, Rtt.; *Oryctes nasicornis*, L., the larvae of which were found in company with those of *Melolontha afflicta*, Ball.; *Amphimallus* (*Rhizotrogus*) *solstitialis*, L.; *Polyphylla adspersa*, Motsch; *Pachydissus sartus*, Sols., which occurs in two generations and has infested poplars, willows and apple trees; *Scolytus fasciatus*, Rtt.; *Galerucella luteola*, Müll., injuring the local variety of elm (*Ulmus turkestanica*); *Melasoma* (*Lina*) *populi*, L., and *Plagiodera versicolor*, Laich., injuring poplars and the latter also willows; *Polydrosus obliquatus*, Faust, found together with *P. dohrni*, Faust,—the latter being erroneously recorded as *P. ferganensis*, Faust, in a previous paper [see this *Review*, Ser. A, ii, p. 714]—and injuring leaves of fruit trees, mostly apples and pears; *Lytta pilosella*, Sols., injuring flower and leaf buds of apples and pears; *Capnodis tenebricosa*, Hbst., gnawing the young shoots and leaf petioles of pears in May; the Geometrid, *Pterotocera declinata*, Stgr. (erroneously referred to as *Biston cinerarius*, Ersch., in the above-mentioned paper) were sent from Isphara, where the caterpillars destroyed the foliage of apricots; *Hyponomeuta variabilis*, Zell.; *Coleophora* sp., the damage done by which was intensified by the caterpillars of *Recurvaria nanella*, Hb., *Eucosma* (*Tmetocera*) *ocellana*, F., and *Tortrix* (*Pandemis*) *chondrillana*, H.S.; *Blastodacna* (*Laverna*) *hellerella*, Dup., injuring apple shoots near Samarkand [see however this *Review*, Ser. A, ii, p. 342, note]; *Sarrothripus musculanus*, Ersch., injuring walnuts near Tashkent; *Vespa crabro*, L., and *V. germanica*, F., damaging ripe fruit in vineyards and orchards; *Locusta viridissima*, L., gnawing apples and cherries near Samarkand; *Physokermes coryli*, L., damaging stone fruits; *Eulecanium* (*Lecanium*) *bituberculatum*, Targ., on young apples and pears; *Lepidosaphes ulmi*, L.; *Lachnus persicae*, Chol., mostly on peaches and occasionally in small colonies on apricots; *Eriophyes pyri*, Pagst., and *E. vitis*, Land.

Field crops and market-gardens were attacked by:—*Laphygma* (*Caradrina*) *exigua*, Hb.; *Chloridea* (*Heliothis*) *dipsacea*, L., on lucerne

and cotton; *Eubolia arenacearia*, Hb., on lucerne; *Pieris brassicae*, L.; *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.); *Hypera* (*Phytonomus*) *variabilis*, Hbst.; *Sitones longulus*, Boh., in roots of lucerne; *Lema melanopus*, L., on wheat and oats; *Chaetocnema breviuscula*, Fald., on beet; *Epicauta latelineolata*, Muls., on potatoes, but also observed amongst crops infested with locusts; *Oscinis pusilla*, Mg., on wheat; *Aphis brassicae*, L.; *Aphis gossypii*, Glov., and *Thrips flavus*, Schr., on young cotton plants.

The following species of locusts are mentioned: *Dociostaurus* (*Stauronotus*) *maroccannus* was present in varying numbers; large outbreaks were reported in the mountains of Kopet-Dagh, on the Persian frontier, and it is probable that these mountainous districts serve as breeding places, notwithstanding their severe climate; in South Bokhara the insects hatched out over an area of 108,000 acres. In company with this species there were also frequently found: *Dociostaurus* (*Stauronotus*) *kraussi*, Ing.; *Oedaleus nigrofasciatus*, De G.; *D.* (*S.*) *albicornis*, Ev.; *D.* (*S.*) *hauensteini*, Bol.; *Stenobothrus* sp.; *D.* (*S.*) *anatolicus*, Kr., and *Calliptamus* (*Caloptenus*) *italicus*. Except for *D. maroccanus* and to a slight degree *D. kraussi*, the other species of this genus are comparatively harmless, as they do not collect in swarms and do not migrate. *Locusta* (*Pachytylus*) *migratoria*, L., occurred in many parts of the country in large numbers, their breeding places being situated in the lake district formed by the flooded river-beds of Syr Daria which are covered with reeds and bushes. Some of the swarms extended over 13 miles and destroyed wheat and barley; in some places, near cotton plantations, they were effectively checked by spraying with Paris green and lime.

Two pests of stores are also mentioned, viz:—*Hypsopygia costalis*, F., on clover-hay, and *Plodia interpunctella*, Hb., in dried peaches.

The report for 1913 mentions the following additional pests:—*Tetranychus telarius* and wire-worms on cotton; *Sitones cylindricollis*, F., on lucerne; *Eurydema maracandicum*, Osh., seriously damaging cabbage; *Hoplocampa fulvicornis*, Klug, on plum trees; *Cosmia subtilis*, Stgr., on apricots; *Euproctis* (*Porthesia*) *kargalika*, Moore, which replaces locally the European *E. chrysorrhoea*, L.; *Rhynchites auratus*, Scop.; *Apterona crenulella*, Brd. (*Psyche helix*, Claus.) on apples; *Aphis pomi*, de Geer; *A. pyri*, Koch, and *Hyalopterus pruni*, F. The usual species of locusts were again present in varying numbers.

The insects dealt with in the report for 1914 include the Psychid moth, *Amicta armena*, Heyl., which appeared in the Starvation Desert in great numbers and invaded cotton and lucerne fields; *Lampides* (*Lycaena*) *baetica*, L., the caterpillars of which injured beans, etc.; *Orgyia prisca*, Stgr., eggs of which were found on apple trees; *Antispila rivillei*, Stn.; *Lithocolletis populifoliella*, Tr., which chiefly injured white poplars, being only found in small numbers on black poplars; *Cydia pomonella*, *C. funebrana* and *Lachnus viminalis*, Boyer. Locusts were, on the whole, not numerous.

The author also gives some additional information with regard to several insects previously recorded by him. *Pterotocera declinata*, Stgr., hatches, not in spring, but in late autumn and winter. *Polydrosus dohrni*, Faust, oviposits in heaps inside the calices of apples. Ants which do not attack living individuals of *Lachnus persicae* were

observed to search for those infested with parasites (*Aphidius* sp ?) and, having gnawed a ring round the body of the insect, to extract the larva of the parasite and carry it away. A parasite of *Psylla pyricola*, Först., was observed, but not yet identified, no parasites of this insect having been previously known. Only infested nymphs were found, the body being fixed to the surface of the leaf with web produced by the parasite before pupating; kerosene lime emulsion, while destroying the larvae and nymphs of *Psylla*, proved harmless to the parasite. The life-histories of the moths, *Orgyia prisca*, Stgr., and *Amicta armena*, Heyl., were also studied.

The report for the last year is incomplete, as the author has been called up for military service. In dealing with the campaign against locusts, it is stated that the disappearance or decline of *D. maroccanus* in some parts of the Starvation Desert may be due to the cutting of irrigation channels, which has been followed by a large invasion of birds. Observations on *Locusta migratoria* and *L. danica* show that the eggs of *L. danica* are able, under favourable conditions, to hatch in about 16 days, while those of *L. migratoria* hibernate, the development of the embryo stopping at a certain stage. Thus *L. danica* frequently gives rise to a second generation, and once even a third was observed late in autumn. The second generation, however, in its adult stage usually loses some of the typical characters of *danica* (such as the bow-shaped outline of the pronotum and the red tibia of the hind leg), but the size of the males remains small. At the same time, examples of *L. migratoria* were found together with these in the open in 1913 having red tibiae instead of yellow ones. This question is however further complicated by the fact that eggs obtained by crossing a male of *danica* with a female of *migratoria* partly gave rise to a second generation and partly hibernated, while from those obtained by crossing the same male with a *danica*-like female of *migratoria*, no second generation was obtained. It is thought to be impossible to define limits for these species and *L. danica* is regarded as being a variety in the act of separating from the parent species. Experiments confirming the occurrence of parthenogenesis in *Locusta migratoria, D. maroccanus* and *C. italicus* are described.

Observations were also made on the biology of the following beetles, *Polyphylla tridentata*, Rtt., *P. adspersa*, Motsch. and *Melolontha afflicta*, Pall. The first-named species prefers shaded soil; the adults take practically no food, each female lays about 30 eggs, usually two or three days after the exit from the soil; the development of the egg lasts 28–31 days, the larvae moult twice and live three or four years before pupating, the majority of them hibernating twice in their third stage. *P. adspersa* usually lives in the soil of orchards and has a similar development. No descendants were obtained from crossing males of *adspersa* with females of *tridentata*, although a few eggs were laid, as in the case of unfecundated females, but normal oviposition was obtained by crossing males of *tridentata* with females of *adspersa*, though the larvae were weak and did not mature.

The income of the Station for 1912 amounted to nearly £1,000, and for 1913 and 1914 to about £800, the money being provided partly by the Local Authority and partly by the Department of Agriculture. In addition, some £500 was spent in 1914 on the actual campaigns against insect pests.

SEVASTIANOV (I.). **Къ вопросу о мѣрахъ истребленія мароккской кобылки въ Туркестанѣ. (Сообщеніе второе и сообщеніе третье).** [On the question of the means of destroying *Stauronotus maroccanus* in Turkestan. (Second and third report.)]—Published by the Turkestan Entomological Station, *Tashkent*, 1915, 88 pp. [Received 7th April 1916.]

These two reports form the continuation of a previous one [see this *Review*, Ser. A, ii, p. 480]. In the first of them the author reiterates his opinion as to the good qualities of Locusticide, based on the results of its application during the campaign against locusts in Turkestan in 1914 and 1915. The main difficulty appears to be to obtain the material containing 36 per cent. of sodium arsenite and of pure quality. In the second report a number of experiments carried out with poisoned baits are described, Locusticide being the poison used. The results show that in order to be effective, the proportion of Locusticide to bran must be at least as 1 to 5, a higher proportion being preferable (the proportion of sodium arsenite must be 1 in 8, or 1 in 9). The amount of locusticide required for this method is larger than in the sprays, as the poison in the baits is washed away by heavy rain, but on the other hand it is quite harmless to crops in any strength and can also be used in localities where there are no crops, where spraying operations are not practicable. Comparative experiments with this and other insecticides used as poison for the baits, showed that London purple is the most suitable, being unaffected by rain. The method of poisoned baits is specially important for the control of locusts invading cotton plantations. In a supplement to this report, the view of Uvarov [see this *Review*, Ser. A, i, p. 542] that spraying operations can also be made use of against winged locusts during the pairing and oviposition period, is confirmed.

SEVASTIANOV (I.). **Условія производства опытовъ, входящихъ въ сферу сельско-хозяйственной Энтомологіи въ Туркестанѣ.** [On the conditions of carrying out experiments in the sphere of Economic Entomology in Turkestan.]—Published by the Turkestan Entomological Station, *Tashkent*, 1915, 31 pp. [Received 7th April 1916.]

This memoir, presented to the Provincial Authority, describes some of the difficulties the local entomologists have to meet, when carrying out practical experiments. The author suggests that the Central Government should control in some way the Russian Agricultural Chemical factories, which frequently put on the market insecticides and fungicides which are impure and dangerous to plants; that an analytical chemist should be appointed by the Provincial Authority, and that in cases of damage to orchards resulting from the experiments, the Central Authority should undertake to compensate the owners.

SHEVTCHENKO (P.). **Обзоръ сельско-хозяйственныхъ культуръ Кокандскаго уѣзда.** [A review of agricultural cultivations in the district of Khokand (province of Ferghana).]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 7, July 1915, pp. 706–713. [Received 10th April 1916.]

During the first part of the summer of 1915, maize and millet were

injured by *Gryllotalpa* sp., and lucerne by *Hypera* (*Phytonomus*) *variabilis*. Among orchard pests, *Biston cinerarius* and *Cosmia subtilis* were observed, but no serious damage was done by them.

SEVASTIANOV (I.). **О борьбѣ съ улитковой щитовкой.** [On the control of *Lepidosaphes ulmi*, L.]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, no. 7, July, 1915, pp. 719–721. [Received 10th April 1916.]

In reply to a subscriber, the author gives a list of the commoner COCCIDAE in Turkestan, including *Lepidosaphes ulmi*, L., attacking apple and pear; *Physokermes coryli*, L., attacking all kinds of fruits; *Eulecanium* (*Lecanium*) *bituberculatum*, Targ., mostly attacking apples; and *Epidiaspis piricola*, Del Guerc., attacking stone fruits. The usual remedy applied in Turkestan consists in smearing the trees with milk of lime, as an improvement on which the author recommends removing the old bark and spraying or smearing with California mixture, by which means many other insects will also be destroyed.

KOROLKOV (D. M.). **Испытаніе мѣръ борьбы съ медяницею.** [The testing of methods of control of *Psylla mali*.]—**«Матеріалы по изученію вредныхъ насѣкомыхъ Московской губерніи.»** [*Materials for the study of insect pests of the govt. of Moscow*], *Moscow*, vi, 1915, pp. 44–54. [Received 10th April 1916.]

Comparison between various orchards as to the degree of infestation with *Psylla* showed that young orchards, as well as small, isolated ones, are less infested than old orchards or those occurring close together over large areas; this may be due to the better circulation of air round the trees in isolated orchards. A frost that occurred in the night of the 30th May did not affect the insects, as the larvae were inside the buds and between the buds and the petioles of the leaves and were already in an advanced stage of development. The unfolding of the buds in 1914 occurred before the larvae hatched, which allowed the insects to penetrate immediately into the buds and made their control by spraying more difficult. This fact is of great importance in deciding upon the method of control to be applied, i.e., whether to direct the campaign against the eggs or the larvae. A number of tables are given showing the results of various sprayings, carried out on a large scale. It appears that a single spring spraying with copper sulphate (2 lb. in about 3 gallons of water) does not affect the eggs; this is also the case with a double spraying in autumn, though this strength had no bad effect on the buds. Better results are obtained when the spring spraying was repeated after two or three days. Spraying with milk of lime directed against *Anthonomus pomorum* had an indirect effect on *Psylla*, in that a thick coat of the lime delayed the development of the buds and the early larvae of *Psylla* perished, not being able to find food. Spraying with a weak solution of tobacco extract against the larvae which have just penetrated into the buds, is not regarded as entirely useless, and it is also useful to apply this spray at the time when the larvae and nymphs are present at the end of the petioles of fully unfolded leaves. As a summary of all the

experiments, which were started in 1912 and continued in 1913 and 1914, it is asserted that the best remedy against the eggs of *Psylla* is to spray with copper sulphate in spring, in calm weather, shortly before the larvae begin to emerge, and to repeat this after a short interval; the spraying is more effective if flour paste is added [see this *Review*, Ser. A, ii, p. 367].

KAZANSKY (A. N.). **Яблоновый цвѣтоѣдъ или яблоновый долгоносикъ.** [*Anthonomus pomorum*, L.]—**«Матеріалы по изученію вредныхъ насѣкомыхъ Московской губерніи.»** [*Materials for the study of insect pests of the govt. of Moscow*], *Moscow*, vi, 1915, pp. 55–156. [Received 10th April 1916.]

A general review of the life-history of *A. pomorum* is given, showing that it occurs as an imago for 11 months of the year, one month being required for the attainment of that stage from the egg. The adults are not injurious to any noticeable degree. A series of investigations showed that the weevils hibernate in a great variety of places, especially on the surface of the earth, in similar situations as many other species of *Anthonomus*; such as, *A. rectirostris*, L., in dry leaves underneath bird cherries; *A. pedicularius*, L., underneath service trees; *A. rubi*, Hbst., underneath raspberries; and *A. varians*, Payk., in the needles under pine trees, etc. Other insects wintering in these situations included:—*Adalia* (*Coccinella*) *bipunctata*, L., *Anthocoris nemorum*, L., and *Sciaphilus asperatus*, Bonsd., the last-named beetle having been observed to injure leaves of raspberries. As the insects also winter underneath the bark of any available trees, it is asserted that the cleaning of the bark and liming of apple trees, usually recommended as a remedy against *A. pomorum*, does not deprive them of a wintering place, and if nothing else is done, these measures are of little practical value. Adhesive belts in spring at the best delay the weevils for some time from reaching the buds. In autumn the belts are more effective, as the insect is then in search of a protected place for hibernation; but every tree in the orchard must be banded, and this measure supplemented by shaking down the weevils on to sheets. This is regarded as the best and principal remedy and must be done in calm, warm weather in the middle of the day. When apple blossoms are not available, pear blossom is attacked; in the laboratory the insects also fed on buds of medlar and service trees, and to a less extent on bird-cherry, but refused cherries. Oviposition, the method of which is described in detail, is usually effected in half-matured, unopened buds, and it appears that in some years the maturing of the females may not coincide precisely with that period in the development of the buds. This was the case in 1914, when the females were very late in ovipositing, the majority of buds being nearly in flower and so friable that oviposition could not be effected in them. Only late flowering varieties of apple, and those of which the normal blossoming was delayed, therefore suffered. Spraying with pure milk of lime proved useful in keeping the weevils away during the oviposition period, but repeated and late sprayings affect the yield of the trees.

Natural enemies of *A. pomorum* include:—the bug, *Anthocoris nemorum*, both the larva and imago of which prey on the weevil larvae and pupae, and *Byturus tomentosus*, F., and *Meligethes* sp., which

indirectly destroy the larvae and pupae of *A. pomorum*, by attacking the buds of apples in which they are present. An internal parasite of the hibernating imago was found in two cases in its larval stage, but not identified; other Ichneumonid and Chalcidid parasites were found in the adult larvae, pupae and even young imago. The buds, which for some reason or another dropped from the trees, were found to contain a larger percentage of parasitised insects than those remaining on them.

Отчетъ о дѣятельности Рижскаго Отдѣла Императорского Россійскаго Общества Садоводства за 1914 годъ. [Report on the work of the Riga branch of the Imperial Russian Society of Horticulture for 1914.]—**«Вѣстникъ Садоводства, Плодоводства и Огородничества.** [*Messenger of Horticulture, Fruit-Growing and Market-Gardening*], *Petrograd*, no. 11–12, November–December 1915, pp. 793–817. [Received 10th April 1916.]

The orchard pests recorded in this paper include:—*Choreutis parialis*, of which the second generation was particularly numerous; *Cydia pomonella*, for the caterpillars of which belts made of felt were found especially attractive; *Anthonomus pomorum*; *Psylla pyricola*, against which spraying in autumn with 6 per cent. copper sulphate was very effective; *Recurvaria* (*Gelechia*) *nanella*; *Aphis pruni*, against which a decoction of quassia was effective; and *Lepidosaphes ulmi* (*Coccus conchiformis*).

Cabbages were injured by *Plutella maculipennis* (*cruciferarum*); the best results were obtained by powdering the plants, when the dew was on them, with a mixture of basic slag and Paris green in the proportion of 100 to 1; spraying with Paris green was ineffective; the same remedy was also used with good results against *Pieris brassicae*, the larvae of which were also collected and crushed by hand; for the control of *Chortophila* (*Anthomyia*) *brassicae*, lime was dusted round the stalks near the soil so as to prevent oviposition.

VASSILIEV (I. V.). **Насѣкомыя и другіе вредители хлопка въ Ферганской области, наблюдавшіеся въ 1914 году.** [Insects and other pests of cotton in the province of Ferghana, observed in 1914.]—**«Труды Бюро по Энтомологіи Ученаго Комитета Главнаго Управленія Землеустройства и Земледѣлія.»** [*Memoirs of the Bureau of Entomology of the Scientific Committee of the Central Board of Land Administration and Agriculture*], *Petrograd*, 1915, xi, no. 6, 27 pp., 10 figs. [Received 10th April 1916.]

This is a continuation of previous work by the same author [see this *Review*, Ser. A, ii, p. 311] and contains a report of his investigations in 1914. The most serious pests of cotton in the year under report were: *Tetranychus telarius*, L., *Aphis gossypii*, Glov., *Thrips flavus*, Schr., and *Euxoa segetum*, Schiff. The caterpillars of the last-named did considerable damage to young plants; some females were caught as early as the middle of April and the first injury was noticed about a fortnight afterwards; the caterpillars were found to injure germinating

cotton while still underground, as soon as the cotyledons begin to emerge. *Thrips flavus*, Schr., was observed everywhere on cotton, in some cases as early as the 15th May, the hibernating imago having been found on neighbouring lucerne fields in the first half of April. When the cotton seedlings appeared, the insect passed to the cotton fields, where they remained until early in September, when they returned to lucerne. In addition to cotton this insect attacks other plants, such as cucumbers, melons, marrows, etc., in summer. The number of generations is probably considerable. *Aphis gossypii* was found on marrows, melons and cotton. The practice, common in many parts of Turkestan, of planting marrows and melons amongst the cotton is therefore to be deprecated. Laboratory experiments show that these Aphids can withstand as low a temperature as from 35° F.-40° F. without injury, and that they do not produce sexual individuals even late in the autumn. Soft soap (about one-third lb. in 3 gallons of water) and common soap (½ lb. in the same amount of water) gave satisfactory results, and the cost of applying this remedy does not exceed 7s. 6d. per acre under conditions in Turkestan. In addition to cotton, *Tetranychus telarius*, L., feeds on various species of *Convolvulus*, *Heracleum* (cow-parsnips), Cucurbitaceae and maize; as maize is frequently cultivated among the cotton plantations, it thus assists the propagation of this mite. In the mountains, *T. telarius* occurs up to the limit of *Juniperus excelsa*, on the needles of which it was found in large numbers. The mites winter and pass the spring and autumn on weeds, etc., along the boundaries of fields and roads and thus the cotton plants adjoining these spots are the first to be attacked.

Amongst the minor or casual pests of cotton the following were observed:—*Pyrausta nubilalis*, Hb., which occasionally injures cotton in the same way as it does maize; *Platyedra* (*Gelechia*) *vilella*, Zell., the larvae of which live on the leaves in their early stages, subsequently boring into the stems; the early stages of this species are described for the first time: *Polia suasa*, Schiff. (*Mamestra dissimilis*, Knoch), not previously recorded on cotton, the caterpillars being also found on lucerne, apples, etc. Single individuals of *Chloridea obsoleta*, F. (*Heliothis armigera*, Hb.) were also found on cotton, but they largely attacked other plants, especially tomato and *Abutilon avicennae*, a common weed in Turkestan. These plants may therefore be used as trap crops. Some of the caterpillars were parasitised by *Habrobracon plotnikovi*, Kokujev.

The other pests observed during the year under report were:—*Acronycta rumicis*, L. var. *turanica*, Staud., *Tortrix* (*Pandemis*) *chondrillana*, HS., *Acridium aegyptium*, L., *Gryllus desertus*, Pall. var. *melas*, Charp., the hibernated adults of which may occasionally attack the cotyledons, *Gryllotalpa unispina*, Sauss., *Acyrthosyphon gossypii gossypii*, Mordv., *A. vasillievi*, Mordv., a species of *Tychea* not yet identified attacking the roots, *Adelphocoris lineolatus*, Goeze, *Lygus pratensis*, *Chlorita bipunctata*, *Agallia sinuata*, *Deltocephalus* sp., and *Agromyza flaveola*, Fall.

GOMILEVSKY (V.). **Сумахъ или желтникъ, его значеніе, какъ дубильнаго и красильнаго кустарника.** [*Rhus cotinus*, L., its importance as a plant used in tanning and dyeing.] — **« Прогрессивное Садоводство и Огородничество.»** [*Progressive Horticulture and Market-Gardening*], *Petrograd*, no. 11, 16th March 1916, pp. 339–343.

It is stated that no insects have ever been observed by the author in the Governments of Podolia, Cherson or Bessarabia to injure *Rhus cotinus*, and it is thought that the odour of this plant, and the tannin it contains, keeps them away. It is also free from the attacks of fungi.

SUDEIKIN (G.). **Отчетъ о дѣятельности Станціи по борьбѣ съ вредителями растеній при Воронежскомъ Губернскомъ Земствѣ въ 1913 году.** [Report on the work of the Station for the control of pests of plants under the Zemstvo of the govt. of Voronezh for 1913], *Voronezh* (N.D.), 9 pp.

SIGRIANSKY (A.). *Id.* for 1914, *Voronezh* (N.D.), 6 pp. [Received 18th April 1916.]

These two reports, for the second and third years respectively of the existence of the Station, give a general account of the consulting and teaching work of the staff. Practical classes on the control of pests were held in May 1913 and in June 1914, the courses including lectures on the chief pests and diseases of plants in the government, preparation of insecticides and fungicides, and practical exercises and excursions; the cost of the classes in 1913 amounted to £20. Similar courses were held at various places in the Government and travelling detachments of instructors were also organised. The expenditure of the Station in 1931 amounted to £1,020 and in 1914 to £1,200, defrayed partly by contributions from the Department of Agriculture, and partly by the Zemstvo.

RAKUSHEV (F. N.). **Борьба съ вредителями посредствомъ соломенныхъ колецъ.** [The control of pests by means of straw-belts.] **« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 3, March 1916, pp. 139–145, 3 figs.

The adults of *Anthonomus pomorum*, even when hungry, rarely touch the leaves of plums and pears, but the leaves of apples are devoured from the under-surface. Spring spraying with milk of lime, mixed with crude carbolic acid (2 lb. to 30 gallons of the milk), gave fairly good results, but does not completely prevent oviposition. During five years, experiments with straw belts showed that the most effective type of belt is provided by ropes of straw twisted round the trunk in such a way that the first and second bands are parallel a few inches from each other, the third one covering both of these and forming a hollow space underneath it, in which the insects hide freely. The whole is then covered with ordinary packing paper, acting as a waterproofing. Such a belt can be smeared with adhesives and thus used in spring to prevent various insects from reaching the crown of the tree. In

November 1915 the following insects were found inside such belts:—*Anthonomus pomorum*, *Cydia pomonella*, *Scolytus mali*, *Euxoa segetum*, *Acronycta rumicis*, *Tingis pyri* and a great number of other insect pests. The small numbers of the principal pests are attributed to the effect of five years' application of such belts. The belts were put on in autumn, or in February, the trees being previously covered with milk of lime, so that all cracks, etc., should be stopped up. If put on in spring, they can be re-smeared in autumn with an adhesive against *Cheimatobia brumata*. Where straw is scarce and expensive, the belts when removed can be put in hot water for five minutes and then dried and replaced. These belts do not allow of spraying being dispensed with, but ought to reduce the amount that is necessary by at least half.

VERESHTCHAGIN (B.). **Опыты борьбы съ пьявицей въ Бессарабіи.** [Experiments on the control of *Lema melanopa*, L., in Bessarabia.] Reprint from **«Бессарабское Сельское Хозяйство.»** [*Agriculture of Bessarabia*], *Kishinev*, no. 19, 1914, 4 pp. [Received 25th April 1916.]

The Chrysomelid, *Lema melanopa*, L., is a serious pest of summer sown crops in the government of Bessarabia, injuring oats, barley and wheat. The imagines winter in the soil, emerging in April and eating the leaves; the eggs are laid on the leaves; the larvae live about a month feeding on the leaves and pupate in the earth. Experiments were made against this pest with various remedies, such as spraying with Paris green and djipsin, powdering with a mixture of Paris green, cement and sand, and cement and sand alone. A death-rate of 100 per cent. was observed when powdering with a mixture containing 2 per cent. and 6 per cent. of green, while the mixture without green gave no positive results, the larvae being able to disentangle themselves from the cement and sand. The best and least expensive remedy consisted of spraying with 1 oz. of green and 2 oz. of quick lime in 3 gallons of water, with the addition of some molasses; the spraying must be done immediately the insects appear, adult larvae being less susceptible to the poison and seriously injured plants less able to recover.

VERESHTCHAGIN (B.). **Къ появленію лугового мотылька въ Бессарабіи.** [On the appearance of *Phlyctaenodes sticticalis* in Bessarabia.]—Reprint from **«Бессарабское Сельское Хозяйство.** [*Agriculture of Bessarabia*], *Kishinev*, no. 15, 1915, 4 pp. [Received 25th April 1916.]

A general and popular account of the biology of *Phlyctaenodes sticticalis*, an outbreak of which occurred in Bessarabia in 1915, is given. On behalf of the Station of Kishinev various parts of the government were visited and the damage done investigated; this extended to maize, market-garden crops, beet, peas, sunflowers, hemp, fruit trees and bush fruit; beans and tomatoes escaped. On the whole the damage did not appear to be very serious.

GRANDI (G.). **Contributo alla conoscenza dei costumi e delle metamorfosi del *Tychius 5-punctatus* (L.), (Coleoptera, Curculionidae).** [A contribution to the knowledge of the habits and metamorphoses of *Tychius 5-punctatus*, L. (Coleoptera Curculionidae).]—Separate, dated 18th March 1916, from *Boll. Lab. Zool. Agrar. R. Scuola Sup. Agric., Portici*, x, pp. 103–119, 6 figs.

In April 1915 the attention of the Laboratory was called to a severe invasion of *Tychius* 5-*punctatus* in bean plantations at Ruvo di Puglia. All stages of this Curculionid are described. The adult beetle feeds on the parenchyma of the tender leaves and of the young pod. In the pods the holes bored for feeding do not apparently differ from those made for oviposition, but sections never showed the seeds to be attacked in the former case. Mating usually takes place in mid-April, sometimes in March. After mating the female begins to oviposit and usually selects young pods. The method of oviposition is described in detail. The local damage done was serious. According to the growers the infestations occur at very long intervals and the losses vary from 50 to 75 per cent.; in some cases the entire crop is lost. As natural enemies are not known, soil disinfection with carbon bisulphide (30–50 c.c. per square metre) should be carried out as soon as the crop is harvested or before the new crop is sown. A more radical measure would involve the planting of some other crop for some years by all the growers in the infested region. The collection of the weevils is not a practical measure. A bibliography of seven works completes this paper.

LONDAR (G.). **Bichos damninhos da fructicultura e arboricultura.** [Larvae injurious to fruit and tree culture.]—*Biblioteca Agricola Popular Brazileira, St. Paulo*, no. 22, 1915, 52 pp., 26 figs. [Received 5th April 1916.]

Cerambycid beetles are prominent in Brazil on account of the damage they do to orchards and parks. The following species are briefly described:—*Oncideres amputator*, F., *O. heterocera*, Thom., *O. saga*, Dalm., *O. gibbosa*, Thom., and mention is also made of *O. dejeani*, Thom., and *O. impluviata*, Germ. Mangoes, peaches, roses and guavas are among the many species attacked. The best method of control is to collect and burn all dead branches in January, February and March. *Chrysophyllum raminiflorum*, Cam., which is a tree of some value as timber, is often bored by *Hamaticherus mexicanus*, Thom. (*castaneus*, Bates) to such an extent as to be useless. This insect is attracted by light at night from September to December. Its eggs are deposited in the bark and the larvae mine subcortical galleries until they attain full growth, when they bore to the centre of the trunk and excavate a chamber in which they pupate. The adult makes its exit by the larval gallery. Only weakly, dying or recently felled trees are chosen for oviposition. *H. mexicanus* is also very common on *Sponia micrantha* and this tree is attacked when in vigorous growth, so that, although of no commercial value itself, it becomes of some economic importance. To prevent oviposition in fallen trunks, all that is needed is to decorticate them, especially that part in contact with the ground.

The following are borers of Leguminosae:—*Metopocoilus quadrispinosus*, Buq., which is somewhat rare in entomological collections, though very common in Brazilian forests. The eggs are laid on the branches of Leguminosae and the larvae mine downwards in the stem. The life-cycle of *M. quadrispinosus* lasts two years, the adults appearing in October and November. No practical method of control exists, but the multiplication of the host-trees should be checked. The larva of *Coccoderus novempunctus*, Germ., causes the same injury to Leguminosae as *Diploschema rotundicolle* does to the orange. Infested branches should be collected and split in order to kill the larva; if very numerous they may be burnt. The adult appears in summer. This is also the case with the adult of *Criodion fulvopilosum*, Gahan, which has similar habits. A tree which has been much used for ornamental purposes, *Jacaranda mimosifolia*, has suffered very severely from the attacks of an apparently undescribed Cerambycid. The larvae of this beetle attack trees in vigorous growth, boring internal mines with lateral orifices. The life-cycle lasts two years. The adult appears in October-November.

The following CURCULIONIDAE are among those of economic importance:—*Heilipus catagraphus*, Germ., is very injurious to *Anona reticulata* (netted custard apple), rendering its cultivation impossible in some localities; other fruit trees are also attacked. The larvae develop beneath the bark, and the best preventive control consists in lime-washing the trunks. As a shade-tree, *Nectandra venulosa* ("canellinha") has been largely planted, but when present in numbers, it is now being totally destroyed by *Cratosomus bos*, Gyl. From October to December *C. bos* oviposits on the branches or trunk; the larvae develop in the wood, the mines sometimes attaining a length of from 10 to 13 feet. If the tree is not of sufficient height, the larva enters the roots or turns at the top and bores downwards parallel to the old gallery. In one case a tree of 6 inches diameter contained 52 mines running side by side. The life-cycle of *C. bos* lasts two years. No curative treatment is of the slightest use and *N. venulosa* should not be planted in future. This pest is also very common on Lauraceae in the forests. The larva has a large chitinous plate on the pronotum and another on the anal area. The mines being open at each end, ants easily enter, and the plates protect the larva against these enemies. It is noted that *Cratosomus reidi*, which always closes its bore behind it, does not possess the posterior plate. The adults of *C. bos* feed on the subcortical layer and remove the outer one for this purpose; this injury looks as if it were due to scratches with claws. *Cratosomus pterygomalis* has the same habits as the foregoing insect; it also attacks the kitchen laurel (*Laurus nobilis*) and the camphor tree. The best method of control is collection of the adults in January and February. Another weevil, *Amerrhinus pantherinus*, Oliv., is a pest of *Cocos nucifera* (coconut), which is being extensively planted in the northern states of Brazil. It deposits its eggs in the petiole, usually in batches of three or four. The larvae feed in the petiole, boring longitudinal mines 6 to 8 millimetres wide and 30–40 millimetres long; occasionally the mines go down into the trunk. On attaining full growth the larva makes a cocoon near the bark and enters the nymphal stage, which lasts about twenty days. The adult pierces the bark and emerges, usually in summer. This

pest is very common in the State of S. Paulo and also attacks areca and other palms. The destruction of infested parts is the only remedy. Other weevils attacking indigenous palms are *Homalonotus coriaceus*, Gyl., *H. deplanatus*, Sahlb., *Sphenophorus ensirostris*, Germ., *Rhynchophorus palmarum*, L., and *Acharias parcus*, Fhs.; these may also be able to attack the coconut.

Chrysomelid beetle pests include *Alurnus marginatus*, Guér., which does considerable injury to coconuts through the larvae feeding on the tender leaves in the bud. Leaves already developed are injured in the cortical parenchyma of the petioles right down to the woody tissues, so that decortication results with subsequent rotting. The internal or upper surface of the petiole is the most affected, as rain penetrates into the wounds carrying infective germs with it. *A. marginatus* may be the chief disseminator of bud-rot by facilitating the incubation of *Bacillus coli*. The larva usually remains in the same spot, continuing to feed in the wound first made by it, and attaches itself to the petiole in order to pass the pupal stage. The adult emerges at all seasons and there may be several generations during the course of a year. The adult measures 28 to 30 millimetres in length and 13 to 14 millimetres in breadth. Brazilian palms, such as *Cocos romanzoffiana*, are attacked by the larvae of *Alurnus 4-maculatus*, Guér., and *A. corallinus*, Vig.; these larvae closely resemble those of the preceding species. The larva of *A. corallinus* has also been observed in coconuts in the State of Bahia.

Injurious Lepidoptera include:—*Caligo eurilochus*, Cram., the larvae of which devour the leaves of the banana by night, hiding by day. Collection of the larvae or spraying with Paris green are the controls advised. *Bromelia ananas*, L. (pineapple) is attacked by *Hypolycaena philippus*, F.,* both young and mature fruit being injured. The plants should be inspected, preferably in the morning, in November and December and the larvae should be removed and killed. Both *Cucumis sativus* (cucumber) and *Cucumis melo* (melon) are attacked by the larva of *Zinckenia* (*Margaronia*) *nitidalis*, Cram. The cucumber is mined in the part in which the seeds occur, while in the melon the fleshy part is affected. When the larva is young it feeds on the leaves. On attaining full growth the larva leaves the fruit and passes about 10 days in the chrysalis stage. Spraying with Paris green, 1 in 2,000, when the first flowers appear, and repeating the applications a few times will control this pest. In the case of the cucumber, the skin of which is eaten, treatment should be discontinued when the fruits are formed.

Among the Diptera, *Acanthomera picta*, Wied., is a pest of many trees. The fly oviposits on the bark and the larvae penetrate into the trunk, sometimes boring through its entire diameter, always transversely and never in a vertical direction. The mines are open at the ends for the expulsion of the evil-smelling excreta. The nymphal stage is passed in the mine. The adults are over $2\frac{1}{2}$ inches in length. Indigenous trees are attacked, but the chief injury is done to imported species. The same control methods as those adopted in Europe against the larvae of *Cossus cossus* are advised. Water-melons are attacked by the larvae of the water-melon fly.

* This species has probably been wrongly identified, for *H. philippus* is a purely African butterfly, and the genus *Hypolycaena* is not known to occur in South America.—ED.

SAVASTANO (L.). **Del valore agrario che l'arboricoltore deve dare alla micosi del crisonfalo.** [The agricultural importance of the mycosis attacking *Chrysomphalus dictyospermi*, Mask.]—*R. Staz. Speriment. Agrum. Fruttic., Acireale,* Boll. no. 21, February 1916, 7 pp.

Citrus growers in Calabria having reported the disappearance of *Chrysomphalus dictyospermi*, Mask., investigation showed this to be principally due to the scale being attacked by a species of *Cladosporium*. This fungus is active mainly in the autumn and is more important in its results than the predaceous Coccinellids, *Chilochorus bipustulatus* and *Exochomus quadripustulatus*. These natural enemies do not, however, justify the disuse of the lime-sulphur spray, which should continue to be applied immediately an outbreak of the scale is noticed.

SAVASTANO (L.). **La poltiglia solfo-calcica in sostituzione della cupro-calcica contro taluni parasiti fungini degli alberi coltivati.** [The lime-sulphur spray as a substitute for copper-sulphur against some fungus parasites of cultivated trees.]—*R. Staz. Speriment. Agric. Fruttic., Acireale,* Boll. no. 22, 17th February 1916, 4 pp.

This bulletin deals with the use of lime-sulphur mixture against fungi such as *Exoascus deformans, Cycloconium oleaginum*, etc., and recommends the substitution of it for the more expensive cupro-sulphur spray.

Como combater a praga dos arrozaes. [How to combat rice-field pests.]—*Chacaras e Quintaes, Rio de Janeiro,* xiii, no. 3, 15th March 1916, pp. 188–189, 3 figs.

The beetles, *Dyscinetus geminatus*, F., and *Podalgus humilis*, Burm., are rice-field pests in the Brazilian State of Minas Geraes. Flooding the fields and light-traps are the control measures advised against them.

Un ennemi du framboisier. [An enemy of the raspberry.]—*Progrès Agricole, Amiens,* no. 1472, 2nd April 1916, p. 178.

In reply to a correspondent complaining of injury to raspberry bushes by larvae infesting the stems, the insect concerned is stated to be the Buprestid beetle, *Agrilus rubicola*. The winter collection and burning of the dried stems, the cutting and burning in May of all stems with faded foliage, and the destruction of neighbouring brambles, which also serve as host-plants, are advised against this pest.

RAVAZ (L.). **Répartition des Insectes de la Vigne sur les Souches.** [Distribution of vine insects on the stocks.]—*Progrès Agric. et Vitic., Montpellier,* xxxiii, no. 9, 27th February 1916, pp. 202–203. [Received 12th April 1916.]

Examples are given from two vineyards, one from Castelnau near Montpellier in the Department of Herault and another from the neighbouring Department of the Aude. In the former, five areas were examined and despite a serious attack by the vine Pyralis (*Sparganothis pilleriana*) in 1915, none were found, while the numbers

of *Clysia ambiguella* and *Polychrosis botrana* were very small, though in another vineyard not far away they were abundant. In the other vineyard, *S. pilleriana* was not found on the bark of the trunk, but only on the branches; on the other hand, the remains of cocoons of *C. ambiguella* were found on the trunk and on the branches, respectively, in the ratio of 11 : 3. These figures show the necessity of treating the trunks against *C. ambiguella.*

TROFIMENKO (M.) & OBIEDOFF (S.). **Le Vin des Raisins traités aux Arséniates contre la 2me Génération des Insectes.** [Wine from grapes treated with arsenates against the second generation of insects.]—*Progrès Agric. et Vitic., Montpellier*, xxxiii, no. 14, 2nd April 1916, pp. 331–333.

As arsenical sprays have proved to be very effective against the second generation of *Clysia ambiguella* and *Polychrosis botrana*, experiments were made by the authors to ascertain whether arsenic was present in the wine made from grapes which had been treated in this way. Fruit which showed a continuous layer of arsenical matter over the berry and stalk, and which had not been subjected to rain between the time of application of the spray and the time of picking, was used. As a result, it was found that white wine was entirely free from arsenic, while red wine showed traces (0·0002 gram per litre). The residue could be used for the extraction of tartar, the washing being sufficient to carry away the arsenate. The traces of arsenic contained in red wine were not sufficient to prohibit its consumption. Further experiments in this connection are being carried on.

PASSY (P.). **A propos de la destruction des guêpes.** [The destruction of wasps.]—*L'Apiculteur, Paris*, lx, nos. 1–2, January–February 1916, pp. 17–18. [Received 15th April 1916.]

Carbon bisulphide is stated to be very effective against colonies of wasps. If 1½ to 2 oz. be poured into the entrance of the nest, the death of the insects occurs after a few hours, owing to the fumes being heavier than air. The operation is best carried out in the evening, but may be done by day if necessary.

LÉCAILLON (M. A.). **Sur l'existence de deux générations annuelles chez la Galéruque de l'Orme (*Galeruca luteola*, F. Müller), et sur la manière dont elles se succèdent.** [On the existence of two annual generations in the Galeruca of the elm (*Galeruca luteola*, F. Müller), and on the manner in which they follow one another.]—*C. R. hebdom. Ac. Sci., Paris*, clxii, no. 13, 27th March 1916, pp. 481–484.

In the neighbourhood of Toulouse the eggs of *Galerucella* (*Galeruca*) *luteola* are laid on the leaves of elm from the beginning of May to the beginning of September. Two generations occur annually, the first in May and June, the second in July and August. The duration of the egg-laying period of a single female does not exceed six weeks. Larvae from the first generation of adults were observed to emerge on 15th June 1914; the pupal stage was reached on 3rd July 1914, and adults emerged 10 days later. Egg-laying by the second generation

of adults lasted from 30th July to 4th September. Some of the adults remained alive for four months after oviposition was completed. The two generations show a considerable degree of overlapping and adults of the second generation begin to appear when some of the previous generation are still reproducing. Similarly, adults of the third generation, which constitute the first generation of the following year, begin to emerge before those of the second generation have finished oviposition. It is also possible that some adults of the second generation may hibernate before egg-laying is complete, and then continue to reproduce in the following year, and also that certain adults of the third generation may begin to oviposit before hibernation.

DEGRULLY (L.). **Les Traitements de Printemps contre la Cochylis et l'Eudémis.** [Spring treatment against *Clysia ambiguella* and *Polychrosis botrana.*]—*Progrès Agric. Vitic., Montpellier*, lxv (33rd year), no. 10, 5th March 1916, pp. 221-224.

Immediate control is necessary unless the injury done in 1915 by *Clysia ambiguella* and *Polychrosis botrana* is to be repeated. The combination of insecticidal and anticryptogamic treatment may be effected in two ways, the simplest being the addition of 1 lb. of commercial lead arsenate to every 10 gals. of cupric spray. Another, and more economical method, is to use sodium arsenate alone.

To prepare a cupro-arsenical spray, 10 lb. of copper sulphate is dissolved as usual in about 25 gals. of water and then from 12 oz. to 1 lb. of sodium arsenate—previously dissolved in 2 gals. of water—is added. After mixing for a few minutes, the liquid must be neutralised by adding a sufficient quantity of milk of lime or a dilute solution of sodium carbonate, so that a total bulk of 50 gals. is obtained. It should be noted that lead arsenate is generally held to be more efficient than this formula. Commercial lead arsenates sometimes produce somewhat heavy precipitates which adhere badly to the foliage. Makers seem to have avoided this trouble by modifying the form under which they now sell these products. A cupro-arsenical spray may be, however, prepared in the following manner from sodium arsenate and lead acetate :—Two solutions are made, one containing a double dose of copper, and the other a double dose of arsenic. Thus, if a solution containing 2 per cent. of copper sulphate is required, the copper solution may be prepared by dissolving 20 lb. of copper sulphate in 50 gals. of water with sufficient lime or sodium carbonate to neutralise it, and the arsenic solution is obtained by dissolving 2 or 3 lb. of sodium arsenate and 6 or 9 lb. of lead acetate in 50 gals. of water. On mixing the two solutions, 100 gals. of spray at the proper strength results. In regions with a damp climate the stronger arsenical solution should be used, but in the south the weaker one will suffice, unless caterpillars are present at the end of the season or there are many pupae beneath the bark. While arsenicals are infallible against *Haltica* and the leaf-roller of the vine, they have not always given in the field the results against *Clysia* and *Polychrosis* which might have been expected from experimental work. This is due to the difficulty of ascertaining the proper moment for spraying, owing to the overlapping of the generations, and to the fact that the moths can pass from a neighbouring untreated vineyard to one where spraying has been carried out.

G. B. **Doses d'arséniate de soude et d'acétate de plomb pour obtenir l'arséniate de plomb.** [Quantities of sodium arsenate and lead acetate required for obtaining lead arsenate.]—*Rev. Vitic., Paris*, xliv, no. 1132, 9th March 1916, pp. 194–195.

Lead arsenate, for use against *Clysia ambiguella* and *Polychrosis botrana*, may be obtained commercially or may be prepared from sodium arsenate and lead acetate. The quantities required for 62½ gals. are 30 oz. sodium arsenate and 66 oz. lead acetate, the latter salt being gradually added to the former. Lead arsenate is in a better physical state when it is mixed with acetate of copper (verdigris) than when incorporated into a copper sulphate spray.

FLETCHER (T. B.). **Agricultural Entomology.**—Reprint from *Ann. Rept. Bd. Scientific Advice for India, 1914–1915; Calcutta*, [1916] Economic Zoology, pp. 1–15. [Received 1st April 1916.]

The first part of this paper deals with work done at Pusa. Experiments are still in progress to test the relative immunity of different varieties of cotton to attacks of bollworm (*Earias*). The bollworms found were also examined for the presence of parasites, which were bred out, recorded and liberated in the experimental area. So far as noted hitherto the infestation of *Earias* [*insulana*] by *Rhogas* [*lefroyi*] is less than 5 per cent., even under the most favourable conditions. The life-history of the Cercopid, *Machaerota planitiae*, was studied. This insect lives in a calcareous tube on cotton stems and frequently stunts the growth of the young shoots. With a view to sending parasites of *Chrysomphalus* (*Aspidiotus*) *aurantii* to Italy, a study was begun of the parasites of this scale, which occurs commonly at Pusa on *Citrus* sp., but very few parasites could be obtained. A large amount of material was collected with a view to finding parasites of *Coccus* (*Lecanium*) *viridis* in the coffee districts of South India, but most of the local LECANIINAE were free from Chalcid parasites; only those scales found on *Ficus religiosa* and *Ricinus communis* were parasitised to any extent. Life-histories of *Aleurodes citri*, *A. bergi* and *A. ricini* were studied and attempts made to procure parasites. The complete life-history of the Fulgorid, *Pyrilla aberrans*, was worked out during the year. Chalcid, Dryinid and Stylopid parasites were also reared, some of these being new. It is stated that three species of *Pyrilla* (*P. aberrans*, *P. perpusilla* and *P. pusana*) are found on sugar-cane at Pusa, all of which were formerly confused under the first name. Much time was given to the outbreak of *Nephotettix bipunctatus* (rice leaf-hopper) in the Central Provinces. Of six control measures tried, it was found that putting up lantern traps in the fields was the most efficacious and the most readily adopted by the cultivators.

In the insectary some two hundred insects were studied which had not been previously reared. Among the beetles were many predaceous species, including an unidentified Carabid predaceous on a Cydnid bug; a species of *Chlaenius* predaceous both in the larval and adult stage on caterpillars of *Utetheisa pulchella*, and several Elaterid beetles. Of these last a single grub of *Agrypnus* sp. destroyed more than 200 Scarabaeid grubs in the course of about three months, and another Elaterid larva was found to exercise a considerable control on Tenebrionid grubs feeding at the roots of gram and other crops. It was

found in studying some common insects, such as *Laspeyresia*, *Chilo*, *Chloridea*, etc., reared for observation of exact cycles of their life-history, that out of a batch of larvae, feeding and commencing to hibernate at the same time, some individuals hibernate and emerge as adults, whilst others hibernate during the cold weather, then aestivate during the hot-dry season and emerge at irregular intervals thereafter as late as July and August. From the point of view of control this is of some importance, as measures taken on the first appearance of the insects after hibernation may be rendered abortive, or will at least require to be supplemented, in view of these later emergences. This emphasises the fact that an intimate knowledge of the habits of insects concerned must be the first step towards their control.

Crocidolomia binotalis is a cold weather pest of Cruciferae. Unsuccessful attempts were made to find out how it passes through the rest of the year. *Mylabris* (*Zonabris*) *pustulata* is an extremely common black and red blister beetle whose life-history is yet unknown. Dr. Roepke, of the Experimental Station at Salatiga in Java, informed the author that he had found larvae of this species feeding on egg-masses of *Cyrtacanthacris*, and it is probable that this beetle has a similar habit in India. The Bruchid beetle, *Bruchus affinis*, was observed to lay eggs extensively on pea-pods at Pusa in January and February, so that the peas may be infected in the field before being stored. The life of the adult of *Odoiporus longicollis*, a weevil which bores in plantain stems, has been found to extend to a period of up to two years. With reference to the campaign against *Agrotis ypsilon* at Mokameh [see this *Review*, Ser. A, iv, p. 95] it was not known how this insect passes through the hot weather and rainy season in the plains of India. Under Insectary conditions continuous broods have been obtained, which suggests that it may breed somewhere in the vicinity of the areas attacked from September to December.

Experiments have shown that the adult of *Tenebroides mauritanicus*, as well as the larva, eats wheat and rice grains, preferring wheat to rice. The adult however preys upon the adult rice weevil, *Calandra oryzae*, so that in grain affected by *C. oryzae*, the presence of *T. mauritanicus* is beneficial, as, when present in sufficiently large numbers, they will ultimately rid the grain of the weevils, while the loss through their own attacks will be less than if the weevils occurred unchecked. *Batocera rubus*, a Longicorn beetle commonly boring in fig, mango, etc., has been reared from the egg and the complete life-cycle observed to occupy a year. *Balaninus c-album* has been traced throughout the year; its life-cycle occupies twelve months. Complete life-cycles have been observed of the Lepidoptera, *Selepa* (*Plotheia*) *celtis*, *Euproctis* (*Porthesia*) *xanthorrhoea*, *Perigea capensis*, *Spodoptera mauritia*, *Terias hecabe*, *Hypolimnas bolina*, *Euploea core*, *Precis* (*Junonia*) *orithyia*, *Huphina nerissa*, *Papilio polytes* and *Deilephila nerii*. Some work was done on a Braconid parasite of *Diacrisia obliqua* and an Ichneumonid parasite of *Spodoptera mauritia*.

Fruit-flies have been reared in large numbers in order to procure parasites and to ascertain the proportion parasitised. In the case of *Dacus* (*Bactrocera*) *cucurbitae*, the parasites were very few. Only in one lot of fruits of *Momordica charantia* were the maggots found to be attacked by a Braconid parasite to the extent of about 16 per cent., and even this parasite was not present throughout the year. *Dacus*

(*Bactrocera*) *zonatus* (peach fly) showed an insignificant percentage of parasitism. *Carpomyia vesuviana* was reared from fruits of *Zizyphus jujuba* and was found to be extensively parasitised; attempts will be made to introduce the parasite in question into Italy. In order to test the effect of poisoned sprays on fruit-flies, large numbers, reared in the Insectary, were fed with a solution composed of lead arsenate, 2¼ to 5 oz., gur, 2¼ lb., and water, 4 gals. It was found that a strength of 3 to 5 oz. of lead arsenate killed the flies in about 36 hours.

Odontotermes assmuthi, the largest of the five termites known to occur at Pusa, has been reared from the egg to the adult under observation. It is believed that this is the first time this has been done in the case of the true earth-dwelling TERMITIDAE. Experiments in the preservation of wood against termite attack were continued, *Microtermes obesi* (*anandi*) being the species experimented with. "Powellized" wood failed almost wholly within four years. "Sideroleum," tested as a preservative of wood against termites, also failed, but further tests are being made. Testing of "Microlineum" was begun. Creosote was used in the hopes of making sugar-cane sets immune to termites without interfering with germination, but these experiments failed.

The second part of this paper deals with work in the Provinces.

In Madras an extensive campaign against *Colemania sphenarioides* (Deccan grasshopper) was planned, but owing to climatic causes the outbreak in 1914 was insignificant. Experiments in the control of mango hoppers (*Idiocerus*) were made in the Salem district, the trees being sprayed with crude oil emulsion and with fish-oil soap; successful results were attained. Experiments with light-traps for the control of the rice stem-borer (*Schoenobius*) showed that other means must be sought for combating this most serious pest; this result is identical with that reached at Pusa and in Bombay.

In Bombay light-traps were found fairly successful in the control of the Arctiid, *Amsacta moorei*, 9,062 moths, of which 1,732 were egg-laden females, being caught in about three weeks, with the result that the succeeding attack by caterpillars was insignificant. The moths and egg-masses were also hand-picked, but few were obtained by this method. The regular picking and destruction of first-attacked shoots was found successful in preventing attack of cotton bolls by *Earias*. Some experiments were made on the preservation of seed from insect attack and the results indicated that thorough drying in the sun for three days or fumigation with carbon bisulphide gave the best results.

In the Central Provinces, the chief event was the outbreak of *Nephotettix bipunctatus* referred to in the first part of this report. Borers in sugar-cane were also studied and of these *Scirpophaga* is the worst pest, but experiments proved that its ravages can be reduced to a minimum by planting cane in October and November instead of in February and March as has been the practice hitherto.

In the United Provinces, successful experiments were made in the storage of seed wheat by the use of naphthaline.

In the Punjab, the Dermestid, *Attagenus undulatus*, is the most important of the insects infesting stored wheat and its life-history was worked out. The removal of dead-hearts in young sugar-cane was found satisfactory as a control measure against borers.

In Bihar and Orissa, the campaign against *Agrotis ypsilon* has already been dealt with [see this *Review*, Ser. A, iv, p. 95]. As regards

Phthorimaea operculella (potato moth) the storing demonstrations were discontinued, as the effectiveness of the recommended method of storing had been satisfactorily demonstrated for several years successively.

In Bengal, the " bhepu " disease of rice was found to be due to the attack of a Cecidomyid fly, probably *Cecidomyia oryzae*, Wood-Mason. Experiments to check the mango weevil, *Cryptorrhynchus mangiferae*, by kerosene treatment have given apparently promising results.

In Burma, tests with seeds of *Cajanus indicus*, after treatment with carbon bisulphide, showed that their germination was not affected.

This paper concludes with a list of 64 works, issued during the year ended 30th June 1915, which deal with Indian insects.

BEESON (C. F. C.). **Forest Entomology.**—Reprint from *Ann. Rept. Bd. Scientific Advice for India, 1914–15, Calcutta* [1916]. Economic Zoology, pp. 1-5. [Received 11th April 1916.]

During December and January 1914–15, investigations were carried out in the Buxa and Jalpaiguri Divisions of Bengal in connection with the dying off of sal trees (*Shorea robusta*). Insects were found to be absent from 36 per cent. of the trees examined, at the time of their death. The remainder contained the following insects, before or shortly after death :—*Hoplocerambyx spinicornis*, Newm., 30 per cent. ; *Diapus furtivus*, Samps., 16 per cent. ; *Xyleborus major*, Steb., 5 per cent. ; *Sphaerotrypes siwalikensis*, Steb., *X. fallax*, Eichh., *X. andrewesi*, Bldfd., *Platypus curtus*, Chap., and *D. 5-spinatus*, Chap., 13 per cent. The following species occurred commonly, but in nearly all instances as late arrivals :—*Xyleborus laticollis*, Bldfd., *X. parvulus*, Eichh., *X. perforans*, Woll., *X. schlichii*, Steb., *X. semigranosus*, Bldfd., *X. submarginatus*, Bldfd., *X.* spp. n., *Eccoptopterus 6-spinosus*, Motsch., *Crossotarsus saundersi*, Chap., *C. bonvouloiri*, Chap., *Platypus cupulatus*, Chap., *P. solidus*, Walk., *Dialeges pauper*, Pasc., *Chlorophorus* sp. n., *Xylotrechus buqueti*, Lap. and Gory.

H. spinicornis is to be regarded as a primary pest, the remainder of the species mentioned above being secondary ones and only attacking trees which have been rendered unhealthy by a root fungus. The life-histories of *H. spinicornis* and of some of the Scolytids were studied.

In connection with insects injuring teak, a report on the distribution and seasonal history of the Cossid moth, *Duomitus ceramicus*, Wlk., was circulated in Burma. A study of the Hepialid borer of young trees was begun. The Longicorn, *Haplohammus cervinus*, Hope, was found to cause fissures and cankerous swellings on the stems of poles and saplings in Upper Burma, Northern Shan States, and Assam. Three Longicorns were bred from Burmese teak, viz :—*Glenea galathea*, Thom., *Nupserha variabilis*, Gah., and *Xylotrechus quadripes*, Chevr.

Heritiera fomes, Buch. (sundri), attacked by boring beetles, was found in every case to possess diseased roots. The following insects were bred from dead or dying trees :—SCOLYTIDAE : *Crossotarsus squamulatus*, Chap., *C. saundersi*, Chap. var., *Platypus* sp. n., *Cryphalus* spp., *Xyleborus schlichii*, Steb., *Progenius* (*riehlii* ?). CERAMBYCIDAE : *Gelonaetha hirta*, Fairm. LAMIIDAE : *Glenea* sp. n., a Buprestid three Curculionids, and a Siricid.

Ips longifolia and scale-insects affecting chir pine (*Pinus longifolia*) were investigated. The seasonal history of the Pyralid, *Hypsipyla robusta*, which bores in the shoots of toon (*Cedrela toona*) was studied. Sack-banding of older trees during the first generation of the moth proved an effective control measure. This method, in combination with early pruning during the third generation, is being tested.

The following miscellaneous pests were recorded:—Grasshoppers belonging to the genera *Oedaleus*, *Chrotogonus*, *Teratodes*, on chir seedlings in the Punjab; the Noctuid moth, *Hypocala subsaturata*, Guen., defoliating *Quercus incana* in the Punjab; cockchafer larvae on deodar seedlings in the Punjab; *Scolytus* (*Eccoptogaster*) *major*, Steb., and *S. deodara* on deodar in Madhan State; an unidentified Lymantrid defoliating chir pine in the United Provinces; *Cistelomorpha andrewesi*, injuring kail in the United Provinces; the Longicorns, *Derolus volvulus*, F., and *Glenea spilota*, Thom., bred from *Bombax malabaricum* from Kheri; the Noctuid, *Selepa* (*Plotheia*) *celtis*, Mo., defoliating sal in the United Provinces; the Longicorn, *Coelosterna scabrator*, F., on babul seedlings at Kalpi; an unidentified Lamiid in sandal wood from Madras; *Saissetia nigra*, Nietn., on shoots of sandal in Travancore; the bark-eating caterpillar, *Arbela tetraonis*, Mo., on young casuarina in Bombay; the Lasiocampid, *Metanastria repanda*, Wlk., on *Pinus khasya* in Assam; *Cyrtotrachelus* sp. on *Phoenix paludosa* from Burma; the Longicorn, *Aristobia approximator*, Thom., on *Lagerstroemia flos-reginae* seedlings in Burma and scale-insects, including *Tachardia lacca*, on shoots of *Albizzia lebbek*, in Burma.

BALLARD (E.). *Calocoris angustatus*, Leth.—*Agric. Res. Inst., Pusa*, Bull. no. 58, *Calcutta*, 1916, 8 pp., 1 fig., 1 plate.

The Capsid, *Calocoris angustatus*, Leth., does considerable injury to *Sorghum vulgare* (cholam) and also occurs on a variety of other cereals and grasses, such as *Pennisetum typhoideum* (cumbu), *Setaria italica* (thenai), *Zea mays* (maize) and *Eragrostis abyssinica* (Abyssinian grass). *C. angustatus* makes its appearance as soon as the young ears begin to push their way out of the enfolding leaf-sheath. In the young florets the eggs are laid under the glumes or in the middle of the floret by means of the long scimitar-shaped ovipositor. The time when the most damage is done is probably when the young grains are in the "milk" stage. The continual sucking of large numbers of nymphs and adults at this time causes the grain to shrivel and often the whole ear is seen to be dry and blackened. Eggs are never laid in seed which is set, and when the grains are hard, it is only the young and immature ones which are chosen for oviposition. In the laboratory, oviposition always took place at night, and began from two to three days after pairing. Females were never observed ovipositing in the field, so that eggs are probably laid at night under natural as well as artificial conditions. Incubation takes from five to seven days. Great difficulty was at first experienced in getting the eggs to hatch, and it was eventually found that an extremely moist atmosphere was necessary for them. The eggs hatch in from five to seven days after oviposition. A brief description of each of the five instars is given. The first moult takes place three days after the eggs have

hatched, after which a moult takes place as a rule every two days. The total life-history from egg to adult occupies between 15 and 17 days. Thus at least two generations may occur on one crop, since all ears do not ripen at the same time. A disease, the symptoms of which resemble "pebrine" in silk-worms, is the only natural check known. A bacterium was isolated from infected individuals and grown, but the experiments made to prove whether it was the agent or not were inconclusive. If a dead insect were left in a breeding jar with a healthy one, the latter in the course of two or three days almost invariably contracted the disease and died. The best method of artificial control so far suggested consists of shaking the ear over a tin or pan containing water with a film of kerosene on it. This can however only be done while the stems are young and sappy. Spraying is out of the question, and experiments with light traps proved useless.

Preventive Treatment of Thrips.—*Agric. Gaz. New South Wales, Sydney,* xxvii, no. 2, February 1916, p. 126. [Received 1st April 1916.]

An outbreak of thrips occurred during 1915 in orchards in the Mount Barker district of West Australia. The following preventive measures were suggested :—(1) The destruction by ploughing in or burning of all grass and weeds in or at the edges of orchards ; (2) the application of lime-sulphur or red oil emulsion just before the buds burst ; (3) a tobacco and soap wash spray when thrips are observed on opening flower and leaf buds.

HUGHES (F.). **Fumigation of Cotton Seed by Gaseous Hydrocyanic Acid.**—*Agric. Jl. Egypt, Cairo,* v (1915), nos. 1–2, 1916, pp. 84–90.

This report is published in view of the possibility of the vacuum process for treating cotton seed by hydrocyanic acid being employed in Egypt against the pink boll worm (*Gelechia gossypiella*) and other insect pests. The following conclusions were arrived at :—(1) Although minute quantities of hydrocyanic acid have been found in all samples of treated seed examined, the amount is so small that no fear need be entertained as to its proving in any way toxic. The acid appears to be for the most part expelled or destroyed in the process preparatory to the extraction of the oil. (2) The quantity of hydrocyanic acid found in the cake prepared from treated seed is so small that it would in no way interfere with its use as cattle food. (3) No hydrocyanic acid could be detected in the partly refined oil. No alteration in its character or properties could be detected. (4) The considerable absorption of hydrocyanic acid gas by cotton seed appears to be very largely due to the solubility of the gas in the oil contained in the seed.

STOREY (G. A.). **Notes on Large Scale Experiments against the Pink Boll Worm in Cotton Seed.** [*Agric. Jl. Egypt,* iv, no. 2 (1914) 1915.]—*Agric. Jl. Egypt, Cairo,* v (1915), nos. 1–2, 1916, p. 91.

A note by M. Crovisier on the construction of a full-sized hot air machine for killing pink boll-worms (*Gelechia gossypiella*) in cotton seed, which was omitted from a former paper [see this *Review,* Ser. A,

iii, p. 505], is now published. Trials with the experimental machine showed that the quantity of seed passing through the machine is only about 1 bushel per hour. As such an output is obviously too small, it is suggested that the endless belt of canvas could easily be replaced by one of wire gauze at least 8 feet wide. The nature of this belt would make it possible to treat the seed in a double layer instead of a single one, while the length of the machine could be doubled, and instead of passing once only through the chamber, the belt could be made to do so three times, thus making the capacity of the proposed machine seventy-two times that of the experimental one.

STOREY (G.). **Report on the First Two Years' Working of the Plant Protection Law (Law No. 5 of 1913).**—*Ministry of Agric., Egypt*, Tech. & Scient. Service, Bull. no. 1 (Entom. Section), 1916, 37 pp.

This report embodies the text of the Egyptian Plant Protection Law No. 5 of 1913. From that time further legislation has merely consisted of four Orders, issued under Article 7 of the above law. These provide for the fumigation of the following imports:—Mangoes from the Indies and Madagascar; oranges, lemons and mandarines from Italy, Greece and Syria (which countries are declared to be infested with *Lepidosaphes* (*Mytilaspis*) *beckii*) and from Turkey, Crete and Rhodes (declared to be infested with *Parlatoria zizyphus*); bananas from the Canary Islands, Zanzibar and Madagascar (declared to be infested with *Icerya seychellarum*, *Aspidiotus destructor*, *Pseudococcus citri* and *Chrysomphalus aonidum*.

The following insects have been found on imported fruit:—*Chrysomphalus* (*Aspidiotus*) *aonidum*, *C.* (*A.*) *aurantii*, *L.* (*M.*) *beckii*, *Parlatoria proteus* and *P. zizyphi* on oranges. These five species also occurred on mandarines and, excepting the last, on lemons. Lemons were infested with *Aspidiotus hederae*, frequently found on those from Italy and less so on those from Syria and Cyprus. Sweet lemons, which come mainly from Cyprus, were heavily infested with *C. aurantii* and occasionally with *C. aonidum*, *L. beckii* and *P. proteus*. The chief pests on pomegranates were Pyralid larvae (? *Ephestia* sp.) and a mealy-bug (*Pseudococcus* sp.). On vine leaves and twigs, used as packing for oranges, there occurred *P. proteus*, from Cyprus, *Deilephila livornica* (striped hawk-moth larva), from Syria, *Coccinella septem-punctata*, from Turkey, *Eriophyes vitis*, from Cyprus and Turkey. *Cydia* (*Carpocapsa*) *pomonella* was the chief pest on apples, of which the largest quantity was imported from Greece, Turkey and Italy; *P. proteus* also occurred on apples. Other pests intercepted were *Ephestia cautella* on pears from Syria, *Drosophila melanogaster* on rotten apricots and figs from Cyprus; *P. proteus* and a Lepidopterous larva on peaches from Italy; *P. proteus* on plums, particularly those from Cyprus; a Lepidopterous larva on almonds from Cyprus; *Dacus persicae* and *C. aonidum* on mangoes from India; *Lepidosaphes* (*Mytilaspis*) sp. on olives from Syria. Bananas produced a greater variety of insect pests than any other kind of fruit. These were:—*C. aonidum*, *C. aurantii* and *Aspidiotus destructor* from Madagascar and Zanzibar; *P. proteus* from the Canary Islands and Madagascar; *Lecanium* sp. from Madagascar; *Icerya seychellarum* from Madagascar and China; and *Pseudococcus* sp. from the Canary Islands.

Several consignments of grain and flour have been found infested with grain weevils (*Calandra* spp.), flour beetles (*Tribolium* spp.), *Sitotroga cerealella* (Angoumois grain moth), *Ephestia kühniella* (Mediterranean flour moth), *Tylenchus tritici* (ear cockles) and other less important pests. All these, however, already occur in Egypt, and no steps were taken to prevent their importation.

In an appendix to this paper, it is stated that the above law has been replaced by a new Law, No. 1 of 1916, which embodies the amendments seen to be necessary from the foregoing report. An order has been published comprising measures against:—*Dacus persicae* on mangoes; *Parlatoria zizyphi*, *L. beckii* and *Aspidiotus hederae* on citrus fruits; *A. destructor*, *I. seychellarum*, *P. citri* and *C. aonidum* on bananas. The law prohibits the importation of cotton plants, ginned or unginned cotton, cotton seed and cotton wood, vine leaves, living insects in all stages and bacterial cultures injurious to plants. Except with the permission of the Ministry of Agriculture, the importation is forbidden of:—Date palms, banana plants, sugar-cane or any other plant which may be specified, silk-worms and bees. This also applies to the importation in transit of cotton seed and cotton, ginned or unginned. Various other measures, such as examination, fumigation, etc., are included in the law, the execution of which is entrusted to the Ministry of Agriculture and to the Customs and Postal Authorities.

Gough (L.). **The nature of the damage done by the pink boll worm** (*Gelechia gossypiella*, **Saund.**).—*Ministry of Agric., Egypt*, Tech. & Scient. Service, Bull. no. 2 (Entom. Section), 1916, 6 pp.

This paper embodies the results obtained in an enquiry into the nature of the damage done to cotton-bolls by *Gelechia gossypiella*, Saund. These are given in detail and may be summarised as being: Reduction in number, weight, and vitality; reduction in weight and quality of the lint; reduction in percentage of lint, with a fall in quality of the seed, the place of some seeds being taken by worthless hulls and broken seed. These experiments were conducted with second picking cotton, and others with first picking cotton are therefore desirable; these, when completed, should afford information that will be useful in estimating a crop.

Brittain (W. H.). **Sucking Insects of the Apple.**—*Canadian Horticulturist, Peterboro, Ont.*, xxxix, no. 3, March 1916, pp. 59–60, 1 fig.

The three species of Aphids which injure the apple in Nova Scotia are *Aphis sorbi*, Kalt. (rosy apple aphis), *A. pomi*, De G. (green apple aphis) and *Eriosoma lanigerum*, Hausm. (woolly apple aphis). The character of the injury and methods of control are dealt with in a popular manner.

Ehrhorn (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester & Agriculturist, Honolulu*, xiii, no. 3, March 1916, pp. 67–69.

During the month of December 1915, the following were some of the insect pests intercepted:—*Pseudaonidia trilobitiformis* from citrus fruit in the luggage of a passenger from the Philippines; *Chrysomphalus biformis* and *Diaspis boisduvali* on orchids from New Jersey.

During the month there were bred a total of 14,925 of the following parasites of fruit-flies: *Tetrastichus giffardi*, *Diachasma fullawayi* and *D. tryoni*. These and other parasites were distributed to a total of 14,819. The breeding of the mealy bug parasite, *Paraleptomastix abnormis*, was maintained, but none were liberated on account of the heavy rains.

WOODWORTH (C. W.). **A new spray nozzle.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 25, 20th March 1916, pp. 1177-1182, 1 fig., 2 plates.

A new principle has been discovered in nozzle construction. When two streams meet across half their section, the resulting sheet of spray will be of practically uniform thickness throughout, occupying a plane 45° from the plane of the streams and finally breaking up into drops of great fineness and uniformity. This flat spray is comparable to the hollow cone of spray from a cyclone nozzle as regards a uniform distribution of the water, with the advantage of better aim proper to the flat spray. The new nozzle allows some variation in the size of the spray and can also be made into a long or short-distance nozzle. It can be easily constructed by modifying existing nozzles and may be adjusted if it becomes worn. The plates in this paper illustrate, from kinematographic photographs, various phases in the production of sprays from three kinds of nozzles.

PIERCE (W. D.). **A new interpretation of the relationships of temperature and humidity to insect development.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 25, 20th March 1916, pp. 1183-1191, 2 figs.

The effect of temperature on insect development has often been inadequately recorded, especially the higher limits, largely owing to the fact that most work on the subject has been done in the north temperate zone where temperatures sufficiently high to affect development do not occur, while it is only quite recently that attempts have been made to correlate the humidity factor. The author used as material the records of thousands of individual boll-weevils, *Anthonomus grandis* and *A. grandis thurberiae*, obtained in Texas, Louisiana and Arizona between 1902 to 1915. It is generally held that the activities of a species reach a maximum of efficiency at a certain definite temperature, but the author suggests a zone of humidities and temperatures of more or less restricted area as more probable, and in the case of the boll-weevil this lies near 83° F. and 65 per cent. relative humidity. The relation of the stages of hibernation, activity and aestivation to temperature, and the upper and lower fatal temperatures, have been constantly recorded without reference to the humidity factor. A diagram is given showing a combination of the temperature and humidity records, which results in a series of concentric elliptical areas, each of which represents a stage in the progress from maximum efficiency to dormancy and death. Details are given as to the methods of calculation used. One of the results of this method of record will be the necessity for discarding the conception of separate zones of aestivation and hibernation. The author has repeatedly noticed the impossibility of differentiating between a boll-weevil larva killed by

heat and one killed by cold. Becker has observed in the Ozarks that in the case of *Laphygma frugiperda*, S. and A., the phenomena of the year were reproduced day by day, there being two periods of activity and two of inactivity on hot days, and in different canyons in Arizona the differing climatic conditions have a most marked effect not only on the wild cotton but on the weevils; in some, the weevils have two rest periods in the year and in others they rest from autumn till the following summer. The author proposes to use a long list of technical terms derived from the Greek in connection with this subject, but their general adoption is improbable. The proper correlation of temperature and humidity as affecting the life processes of a given insect should lead to more accurate procedure in the methods of control, e.g., in the date of planting winter crops to avoid damage by the fall army worm (*Laphygma frugiperda*).

SWAINE (J. M.). **A New Species of *Pityogenes*.**—*New York Sta. Coll. Forestry, Syracuse*, Technical Publication no. 2, xvi, no. 1, November 1915, pp. 8–10. [Received 11th April 1916.]

A description is given of *Pityogenes hopkinsi*, sp. n., a Scolytid beetle found in pines throughout the eastern part of Canada and the United States.

BLACKMAN (M. W.). **Observations on the Life-History and Habits of *Pityogenes hopkinsi*, Swaine.**—*New York Sta. Coll. Forestry, Syracuse*, Technical Publication no. 2, xvi, no. 1, November 1915, pp. 11–66, 6 plates. [Received 11th April 1916.]

Pityogenes hopkinsi, Swaine, a Scolytid beetle boring into the bark of pine in eastern Canada and the United States, hibernates in the burrows in the larval, pupal or adult condition. The young larvae burrow entirely in the bark, only entering the sap-wood when nearly half grown and for purposes of hibernation. The pupal chamber and the hibernating and feeding chambers of the adult occur mainly in the sap-wood. It is probable that the adult may pass the winter in a different host from that in which the larval and pupal stages were spent. The emergence of hibernated adults takes place in the latter part of April, the males appearing before the females. The entrance gallery and the nuptial chamber of the brood burrow are constructed in a new host by the male, the time occupied being from two to six days. The nuptial chamber may be entirely in the bark or the sap-wood, or partly in both. Pairing occurs in the burrows; egg-laying begins soon afterwards and continues for a period up to 14 days. The incubation period lasts about seven days. The length of larval life varies with temperature and humidity, the average for spring conditions being from 18 to 25 days. The average duration of the pupal period is five or six days. The offspring of over-wintering adults emerge and attack new hosts in July. Under favourable conditions the adults of the second generation may give rise to a partial third brood in September, the larvae of which hibernate through the winter.

P. hopkinsi breeds only in thin-barked pine, preferring recently cut or suddenly killed branches, or those which have been weakened by other insects or by fungi. Excessive multiplication may be prevented by burning waste material after lumbering operations.

Wireworms.—*Bd. Agric., London*, Leaflet no. 10, February 1916, 8 pp., 9 figs. [Received 13th April 1916.]

The most important wireworm pests in Britain belong to the genera *Agriotes* and *Athous*, and occasionally the larvae of *Lacon* and *Adrastus* are harmful. The eggs are laid in spring and early summer at the roots of plants, especially of grass, in weedy fields and pastures. A soil which has been heavily dressed with stable manure is said to be attractive to ovipositing females. The young larvae may feed on the living roots or on decaying vegetable matter, but in later stages attack living roots and stems. The larval stage may last from three to five years. Pupation takes place in late summer in a cell from 6 to 12 inches below the surface of the soil. *Agriotes lineatus* and *A. sputator* often emerge after three or four weeks and hibernate in tufts of grass, etc.; *A. obscurus* and probably also *Athous* sp. remain below ground until the following spring. Adults are active in spring and summer, feeding to some extent on various leaves.

The larvae attack the roots of cereals during early spring and summer; the seed does not appear to be injured. In the case of tomatoes, a burrow is formed in the stem, extending upwards for several inches above the surface of the soil. Beans and clover seem less liable to attack than other crops, and white mustard and rape are usually, but not invariably, immune.

The larval and adult stages are eaten by birds. The larvae are parasitised by Proctotrupids and by the fungus, *Isaria*. Under normal conditions these enemies do not form an efficient check. Thorough cultivation is apparently the best method of reducing the numbers of the pest. Infested land should, if possible, be broken up in late summer or early autumn to destroy or expose the pupae. Lime or gas-lime, the latter at the rate of 4 tons per acre, have some destructive action. Crops which are more or less immune may be planted on infested land. Corn crops should be rolled to prevent movements of the larvae, and the latter may be attracted by the use of rape cake or rape cake dust scattered over the field. The application of manure while an attack is in progress, will stimulate the growth of the injured plants. In gardens and allotments naphthaline, at the rate of 2 ozs. to a square yard, has been successfully used. It should be well worked into the soil and should be followed by a thorough watering. Traps in the form of pieces of potato, carrot, or beet, poisoned or not, may be placed in the soil. Adults may be trapped in spring or summer by heaps of cut clover, sainfoin or broken rape cake, covered with a tile or board. The traps may be poisoned with Paris green.

Essig (E. O.). **The California Peach Borer,** *Aegeria opalescens*, **H. Edw.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 3, March 1916, p. 107.

Aegeria opalescens is stated to infest severely the myrobalan variety of peach at Niles, California. This variety has hitherto been regarded as resistant to attack.

Essig (E. O.). The Distribution of California Insects. I.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 3, March 1916, pp. 113–120, 6 figs.

The distribution of the following insects in California is recorded:—*Gossyparia ulmi*, L. (European elm scale), *Lepidosaphes beckii*, Newm., *Aleurodes* (*Dialeurodes*) *citri*, Ril. & How., *Taeniothrips pyri*, Dan., *Aegeria opalescens*, Edw., and *Iridomyrmex humilis*, Mayr (Argentine ant).

Maskew (F.). Quarantine Division; Report of the Month of January, 1916.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 3, March 1916, pp. 121–123.

The following pests were intercepted during the month of January 1916:—From Cuba: *Howardia biclavis* on gardenia. From Florida: *Phomopsis citri* on grape-fruit, and *Lepidosaphes beckii* and *Parlatoria pergandii* on orange. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapple; *Coccus longulus* on betel leaves; *Chrysomphalus aonidum* and *Hemichionaspis minor* on palms. From Holland: *Lepidosaphes ulmi* on boxwood; *Phytomyza aquifolii* and *Lecanium* sp. on holly. From Italy: *Aspidiotus hederae* on olive trees. From Belgium: *Aspidiotus britannicus* and *Coccus hesperidum* on bay trees. From Japan: *Hemichionaspis aspidistrae* on aspidistra; *H. minor* on Dracaena; *Agromyza websteri* on wistaria; *Pseudaonidia paeoniae* and *Thyridopteryx* sp. on azalea; *P. paeoniae* and *Lepidosaphes lasianthi* on camellia; Mantid and cicada eggs on persimmon; *L. newsteadi* on umbrella pine; egg-masses of *Lymantria* (*Porthetria*) *dispar* on cedar; Lepidopterous larvae and Mantid eggs on *Thuya*. From Iowa: *Eriosoma lanigerum* on crab-apple. From Mexico: *Lepidosaphes gloveri* on limes; *L. beckii* on limes and coconuts; *Chionaspis* sp. on coconuts. From Central America: *Aspidiotus cyanophylli*, *A. cydoniae*, *Pseudococcus* sp., and *Saissetia hemisphaerica* on bananas. From Manila: Lepidopterous larvae in beans. From Tahiti: *Lepidosaphes beckii* on limes. From Oregon: *Phylloxera vastatrix* on grape-vines; *Eriosoma lanigerum* on pear stock; crown gall on peach, apple, apricot, plum and rose stock. From Texas: *Parlatoria pergandii* on grape-fruit. From Virginia: *Pseudococcus* sp. on roses.

Keuchenius (P. E.). Ziekten en plagen van de Klappenkultuur in Ned.-Indië. [Diseases and pests of Coconuts in the Dutch East Indies.] Reprint from *Teysmannia, Batavia*, no. 10, 1915, pp. 601–612. [Received 13th April 1916.]

This review of pests of the coconut gives brief notes on the damage done and methods of control. Both useful and noxious insects are mentioned, including:—The earwig, *Exypnus pulchripennis*, Borm., which is useful as an enemy of various boring caterpillars. *Cyrtacanthacris* (*Acridium*) *melanocornis* should be caught in the early morning when the locusts are still numbed by the cold and the egg-masses should be sought for and destroyed. Among termites *Coptotermes gestroi*, Wasm., attacks young coconuts as well as other plants. *Lepidosaphes pinnaeformis*, Bch., is common between the

unfolded leaves, which are often completely killed by them; infested leaves should be burnt. *Aspidiotus destructor*, Sign., does much the same damage, but is not yet so great a pest in the Dutch East Indies as in the Caroline Islands.

Lepidopterous pests include *Amathusia phidippus*, L., the Hesperid, *Hidari irava*, Moore, and the Zygaenid, *Brachartona catoxantha*, Hmps., which is the worst pest of the coconut in the Dutch East Indies; the caterpillars eat long furrows in the upper surface of the leaves, causing them to bend and curl and often killing them outright. *Simplicia marginata*, Moore, is best handled by insecticides, but if the attack be serious the leaves should be cut and burned; the caterpillars may also be shaken down and collected on the ground. *Melissoblaptes rufivenalis*, Snell., is found all over Java and causes a great diminution of the crop; the attacked nuts should be cut out; they are easily recognised, as they are never of normal length.

Among Lucanid beetles, *Eurytrachelus bucephalus*, Perty, *E. gypaetus*, Cast., and *Odontolabis bellicosus*, Cast., are the most common and do damage by gnawing the lateral branches of the flowering twigs; *Metopodontus occipitalis*, Hope, and *Prospocoelus zebra*, Ol., are less common; the beetles can be caught in situ in the daytime; all rotten wood should be removed from the plantations as the larvae live in it. As to *Oryctes rhinoceros*, L., and *Xylotrupes gideon*, L., traps of rotting vegetable matter are useful against the former and the removal of all rubbish is useful against both. The leaves are eaten by the Chrysomelid, *Botryonopa sanguinea*, Guér., but this is not yet a serious pest. The larvae of an undetermined Hispid eat the still unfolded young leaves and can only be dealt with by cutting these out and destroying them. The Curculionid, *Rhyncophorus ferrugineus* (*signaticollis*), is said to prefer the foot of the palm for attack, but also makes use of the burrows of *Oryctes.* The large ant, *Oecophylla smaragdina*, is troublesome in two ways, as its bites cause the coolies much discomfort and it also protects scale-insects.

GOODWIN (W. H.). **Carbon Bisulphide and its Use for Grain Fumigation.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, i, no. 3, March 1916, pp. 86-90, 3 figs.

In treating stored grain with carbon bisulphide to destroy weevils, from 5 to 8 lb. should be allowed to every 1,000 cubic feet, if the bin is air-tight. The temperature should be kept between 70° F. and 75° F. Fumigation of grain that is to be used for seed should not be continued for more than 40 hours. The carbon bisulphide may be introduced on cotton waste or be sprayed directly on to the grain.

BALL (E. D.). **Some New Species of *Athysanus* and related Genera (Homoptera).**—*Entom. News, Philadelphia*, xxvii, no. 4, April 1916, pp. 173-176.

The following new species of leaf-hoppers are described:—*Athysanus calvatus* and *A. escalantus*, from Utah, and *A. shastus*, *A. lassus*, and *Platymetopius compactus*, from California.

New Method of Combating Phylloxera.—*Queensland Agric. Jl., Brisbane*, v, no. 3, March 1916, p. 130.

It is stated that experiments in the control of *Phylloxera* by growing tomatoes in infested vineyards are now being carried out in the Province of Lecce, Italy. This method was discovered by chance by a farmer who planted tomatoes between the vines. The latter soon showed vigorous growth; the tomato plants, upon being examined, were found to carry many dead insects upon the roots, owing to the presence in them of a poisonous alkaloid.

Jarvis (E.). **Combating the Cane Beetle.**—*Queensland Agric. Jl., Brisbane*, v, no. 3, March 1916, pp. 169–170.

The rainfall at Gordonvale on 11th and 12th December was followed by a primary emergence of *Lepidiota albohirta* and *L. frenchi*. The attractiveness of certain substances, including oils from plants allied to the food-plants of *L. albohirta*, was tested, but no definite reaction was observed. Laboratory experiments in this connection showed that the beetles are influenced by the odours of cajeput oil, acetic acid, carbolic acid, nitrobenzine, and especially oil of almonds. The aerial movements of the adults are undoubtedly influenced by topographical conditions, the presence or position of feeding trees and the mechanical condition of the soil. At the end of the month large numbers of beetles were killed by a hot, dry spell, including many females which had failed to oviposit.

The Rice Case-Worm.—*Tropical Agriculturist, Peradeniya*, xlvi, no. 3, March 1916, pp. 158–159.

The rice case-worm is a serious pest of rice in Mysore during the months of August, September and October. The plants, which are then about one foot high, show white patches on the leaves, due to the depredations of the larvae. The latter form protective cases from pieces cut from the blade of the leaf. The larvae are adapted for living in water and always drop into the water at the base of the plant when disturbed. Pupation takes place within the larval case. There are several generations annually. A suitable method of control consists in placing a rag soaked in kerosene at the point at which the water enters the field. A thin film will thus be formed over the surface of the water, whereby the larvae will be destroyed. If the owners of affected fields co-operate, the measure can be begun on the higher ground and continued to that below. In this way, less kerosene will be required and a large area will be freed from the pest.

Mackie (D. B.). **Destruction of the Tobacco Beetle** (*Lasioderma serricorne*.)—*Tropical Agriculturist, Peradeniya*, xlvi, no. 3, March 1916, pp. 170–171.

The effect of reduced pressure on beetles infesting cigars was studied by the author. Exposure for three hours at a pressure of 27½″ caused a distension of the insects and a lowered vitality, but on the return of normal conditions they again became active. In the second experiment insects were subjected to 27½″ vacuum, after which carbon

bisulphide was introduced and the pressure reduced to 16"; as a result all stages of the beetles were apparently killed. Cigars subjected to the same treatment were smoked almost immediately after atmospheric conditions were restored. The gold lettering in bands and labels was found to tarnish, but only after a longer interval than that required to destroy insect life. By this means cigars and other tobacco products can therefore be fumigated in case lots, in less time and with greater thoroughness than by older methods. The cost of fumigation is reduced, and the tobacco products can be treated in their ultimate containers. The noxious gases generated during the treatment are entirely removed by the pumps. The only disadvantage is that double fumigation is required in order to guarantee the product to be entirely free from the pest.

DRIEBERG (C.). **Ceylon Agricultural Society; Progress Report lxix.**—*Tropical Agriculturist, Peradeniya,* xlvi, no. 3, March 1916, pp. 188–194.

Insects allied to the red spider of tea (*Tetranychus bioculatus*) occurred on the diseased bark of mandarine oranges at Bentota. The affected trees, especially the bark, should be dusted with flowers of sulphur or sprayed with a contact poison. Banana shoots from Uda Aludeniya were infested with a weevil, probably *Cosmopolites sordidus*, *Aphis* sp., and a Myriapod in the root. The weevil was probably the most important pest and all infested plants should be burned or buried at least three feet deep with a quantity of lime. Kerosene emulsion was successfully used against Aphids attacking *Sechium edule.* Tobacco in bulk was treated with bisulphide of carbon or hydrocyanic acid for the destruction of beetles, probably a species of *Tenebrioides.*

HOWARD (L. O.) & CHITTENDEN (F. H.). **The bagworm, an injurious shade-tree insect.**—*U.S. Dept. Agric., Washington, D.C.,* Farmers' Bull. no. 701, 15th January 1916, 11 pp., 13 figs. [Received 18th April 1916.]

The Psychid, *Thyridopteryx ephemeraeformis*, Haw. (bagworm), is a native of North America and abounds in the southern United States, except in the immediate Gulf region, but is also found further to the north, and there are indications that it has gradually spread into this territory from more southern regions. Though a general feeder, *T. ephemeraeformis* displays a particular fondness for evergreens of all kinds, especially for Arborvitae and it is probable that one of these was its original food-plant. The species becomes exceedingly abundant every few years, and at such times it may be found on shade, orchard and forest trees of nearly every kind. It is fond of willows and maples, particularly the silver maple and its varieties and the related box-elder; it is also found on poplars and mulberries, less so on elms, and apparently still less so on oaks. It feeds more or less freely, however, on most other trees and shrubs, and even on many low-growing plants, such as elder, mallow (*Hibiscus*) and *Ambrosia trifida* (ragweed). It does not seem to live on grasses and herbaceous plants. It hibernates

in the egg-stage within the old female bag, and for this reason hand-picking in winter time is an efficacious remedy. In the late spring the young hatch from the eggs, crawl out upon the twigs, make their way to the nearest leaf and immediately begin to feed and to construct cases or bags for themselves. The construction of the case is described. Towards the end of August, near Washington, the larva completes its growth, attaches its bag firmly to a twig and pupates, the pupal period lasting about three weeks. There is only one generation annually. The bagworm is somewhat extensively parasitised by the Ichneumons, *Pimpla* (*Itoplectis*) *inquisitor*, Say, *P.* (*I.*) *conquisitor*, Say, *Hemiteles* (*Allocota*) *thyridopterigis*, Riley, and by the Chalcids, *Spilochalcis mariae*, Riley, *Chalcis ovata*, Scop. *Dibrachys boucheanus*, Ratz., and *Habrocytus thyridopterigis*, Ashm. Most of these parasites also attack similar tree-feeding caterpillars. Some of the Chalcids are undoubtedly hyperparasites.

Hand-picking the bags in winter will control the pest where it occurs on deciduous trees, but this method cannot well be used with evergreens, unless they happen to be badly defoliated, and spraying becomes necessary. When many trees are infested, it is advisable to keep the hand-picked bags for a considerable time in receptacles, such as barrels covered with netting, so that the numerous beneficial parasites will be able to emerge in the spring. On large trees injury has been absolutely stopped by spraying with Paris green at the rate of 1 lb. to 150 U.S. gals. of water, the trees being completely rid of the larvae. Arsenate of lead will be found even more effective, being more adhesive than Paris green and therefore less likely to be washed off by the rains; 1 lb. of the prepared paste in from 25 to 50 U.S. gals. of water is the strength recommended. The addition of about the same quantity by weight of resin-fish-oil soap as of the arsenical used will enhance the adhesiveness of lead-arsenate. Hand pumps and sprayers are unsatisfactory and one of the best types of orchard power sprayer is preferable, while in the case of tall shade trees such as spruce, cypress, hemlock, etc., high-power sprayers should be used. In the treatment of many trees a greater strength, such as 2 or 3 lb. of lead arsenate to 50 U.S. gals. of water or Bordeaux mixture, is desirable. Strengths of 10 lb. to 50 U.S. gals. of water have been used, but this is unnecessary and may be injurious to the foliage. The best time for spraying is about the time when the eggs hatch or a day or two afterwards.

TUCKER (E. S.). **Protecting Cabbage and Cauliflower from Attacks by Worms.**—*Louisiana State Univ. Agric. Expt. Sta., Baton Rouge*, Bull. no. 154, June 1915, 16 pp., 2 figs. [Received 18th April 1916.]

This bulletin is published in view of the increasing importance of cabbage and cauliflower as truck crops in Louisiana. It deals with *Pieris* (*Pontia*) *rapae*, L. (imported cabbage worm), *P. protodice*, Boisd. (southern cabbage worm), *P. monuste*, L. (large cabbage butterfly), *Phytometra* (*Autographa*) *brassicae*, Riley (cabbage looper), *Euergestis rimosalis*, Guen. (cross-striped cabbage worm) and cutworms. The usual remedies are mentioned, with directions for their application.

Imms (A. D.). Observations on the Insect Parasites of some Coccidae.—*Quart. Jl. Micros. Sci., London*, lxi, no. 3, March 1916, pp. 217–274, 2 plates.

Lepidosaphes ulmi, L. (mussel scale) is the commonest of the injurious COCCIDAE of Great Britain, attacking cultivated fruits and nursery stock, especially apple. Observations made in Cheshire during 1913–15 showed that egg-laying begins about 17th August and continues into September. A single brood occurs each year. The winter is passed in the egg-stage beneath the old scale of the female and larvae emerge about 21st May of the following year. The Chalcid, *Aphelinus mytilaspidis*, Le Baron, is the most important parasite of *L. ulmi* in England. It appears to be generally distributed throughout the country. The parasite is double-brooded, only about 1 per cent. of the adults being males. The adults have very weak powers of flight, and consequently the migration is limited. In the first generation, adults appear in the greatest numbers from the third week in June to the middle of July. The female pierces the scale, and usually deposits one egg on the surface of the host. The larval stage, during which time *A. mytilaspidis* is ectoparasitic, varies from 23 days to more than a month. The pupal stage is passed in the same position, the adults emerging between the middle of August and the first week in September. The adults of the second generation live for a period not exceeding five days; they are parthenogenetic, eggs being deposited on the surface of sexually mature hosts. The resulting larvae have the same habits as those of the previous generation, and become mature towards the end of October or beginning of November. Hibernation takes place beneath the scale of the host and adults emerge in the following year. The results of parasitism by the first generation are complete, the host invariably dying from the attack; the effects of the second generation are partial, since parasitised hosts are usually able to deposit a few eggs. The scales are parasitised to an extent of 7 per cent., and the efficiency of the parasite is therefore much below that of a suitable insecticide, by reason of (1) its limited powers of migration; (2) its relatively low fecundity; (3) its susceptibility to climatic changes; (4) the incomplete results of parasitism by the second generation.

BRITTON (W. E.) & DAVIS (J. W.). **Gipsy Moth Suppression Work in 1915.**—*Rept. Connecticut Agric. Expt. Sta. 1915, New Haven*, 1916, pp. 99–111, 1 fig., 4 plates. [Received 25th April 1916.]

During 1915 the control work against the gipsy moth (*Lymantria dispar*) consisted of inspection, collection of egg-clusters and pupae, banding with tanglefoot, and spraying. As the result of winter inspection, ten towns were found to be infested. Summer work closed on 24th July, except in the north-eastern corner of the state, where it was continued until after 1st August. A special grant was made during the year to enable control measures to be more effectively carried out, and a new bill was introduced, making provision for towns to carry on measures under the direction of the State Entomologist, both against the gipsy moth and the brown-tail moth (*Euproctis chrysorrhoea*).

BRITTON (W. E.) & DAVIS (J. W.). **Brown-Tail Moth Work, Season of 1914-15.**—*Rept. Connecticut Agric. Expt. Sta. 1915, New Haven*, 1916, pp. 111-114. [Received 25th April 1916.]

Control measures against the brown-tail moth (*Euproctis chrysorrhoea*) consisted of an attempt to determine the spread of the insect beyond the present quarantined area and of the collection of nests in towns already infested in order to ascertain the presence of introduced parasites. The introduced natural enemies of the brown-tail and gipsy moths which have become well-established in Connecticut include :—*Apanteles lacteicolor*, Vier.; *Pteromalus egregius*, Foerster; *Monodontomerus aereus*, Walk.; *Meteorus versicolor*, Wesm.; *Compsilura concinnata*, Meigen, and *Calosoma sycophanta*, L. These insects are not yet sufficiently abundant to keep the pests in check, and artificial control measures must be practised in order to reduce the areas infested to a minimum.

BRITTON (W. E.) & LOWRY (Q. S.). **Experiments in Controlling the Cabbage Maggot in 1915.**—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven*, 1916, pp. 114-118, 1 plate. [Received 25th April 1916.]

Chortophila (*Phorbia*) *brassicae*, Bch. (cabbage root maggot), was very abundant and injurious during the year. Adults appeared early and the first eggs were found on 28th April. In the control experiments, plants on thoroughly ploughed and manured ground were chosen. The first larvae were found on 18th May, being more abundant at the lower or north end of the field. Of the various control measures tested, tarred paper disks, crude carbolic acid emulsion, and lime-sulphur sludge proved the most effective. Many eggs were found to be laid on, under, and around the disks, but the resulting injury only amounted to 4·4 per cent. Crude carbolic acid emulsion was prepared according to the formula :—1 lb. hard soap or 1 qt. soft soap; 1 gal. boiling water; 1 pt. crude carbolic acid. About 3 oz. were poured around the stem of each plant on 28th April and 27th May. Examination on 18th June showed an average loss of 6 per cent. Lime-sulphur sludge, diluted with five times its bulk of water, and applied on 26th April at the rate of 3 oz. per plant, gave a resulting loss of 10·8 per cent. The loss in untreated plants was 23·3 per cent.

BRITTON (W. E.). **A destructive European Pine Sawfly in Connecticut** (*Diprion* (*Lophyrus*) *similis*, **Hartig**).—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven*, 1916, pp. 118-125, 3 plates. [Received 25th April 1916.]

Lophyrus pini, L. (*similis*, Hart.) is known to occur in five localities in Connecticut, the food-plants being *Pinus strobus* (white pine), *P. excelsa* (Japanese pine), *P. laricio* var. *austriaca* (Austrian pine), *P. sylvestris* (Scotch pine), *P. montana* (mugho pine), *P. koraiensis* (Korean pine), *P. densiflora*, *P. cembra* and *P. flexilis*. In Europe, injury by this insect has been reported in Russia, France, Prussia, Sweden and England. Under insectary conditions in Connecticut in 1915, two complete generations were observed and males of the third

brood emerged late in the autumn. As conditions at this time were unfavourable, it is possible that a third brood may normally occur. The winter was passed in the pupal stage, the cocoons all being attached to the twigs. Adults emerged from April until 6th July. Larvae of the first brood were observed to feed on the old leaves, while those of the second brood attacked the new leaves which had reached maturity. Early-hatched larvae of the first generation pupated about the middle of June. Second generation larvae fed during August and September. The average duration of the larval stage was 30½ days. The species is markedly parthenogenetic, the larvae from unfertilised eggs being able to develop into hibernating pupae. *L. pini* is attacked by certain American species of parasitic Diptera and Hymenoptera, including the Chalcid, *Pachyneuron* (*Dibrachys*) *nigrocyaneus*, Norton, the Ichneumonid, *Hemiteles utilis*, Norton, and the Tachinid, *Exorista petiolata*, Coq. A bibliography is appended.

BRITTON (W, E.). **The Larch Sawfly,** *Lygaeonematus* (*Nematus*) *erichsoni*, **Hartig.**—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven,* 1916, pp. 125–134, 2 plates. [Received 25th April 1916.]

Lygaeonematus erichsoni was recorded from several localities in Connecticut during 1915. The insect has also caused injury in Massachusetts, Maine, New York and south-eastern Canada, as well as in Germany, Switzerland, Holland, Denmark, Sweden, Finland and Britain. The food-plants are *Larix americana*, *L. europaea*, *L. leptolepis* (Japanese larch) and *L. sibirica*; in Pennsylvania attacks on hemlock have been reported. Injury to the foliage is caused by the deposition of eggs by the female and by the feeding habits of the larva. There is probably a single brood annually. The winter is passed as a larva inside the cocoon and pupation occurs in the spring. The eggs are laid during May in Ontario, and are inserted in the terminal twig, with the result that the twig is killed or permanently injured and distorted. The larvae, which hatch in from 8 to 10 days, feed on the leaves and may cause the complete defoliation of closely-planted trees. Isolated trees are able to recover in most cases, owing to more favourable conditions of light, air, and moisture. The reduced vitality of partly or entirely defoliated trees renders them liable to attack by bark beetles, notably by *Dendroctonus simplex*, Lec. The duration of the larval stage varies from three to four weeks. Pupation occurs at the base of the tree, either in the soil or on the surface beneath litter. Reproduction is parthenogenetic to a very great extent.

The natural enemies of *L. erichsoni* include the meadow mouse and deer mouse, several kinds of birds, parasitic and predaceous insects and a fungus. The Ichneumon, *Mesoleius tenthredinis*, Morl., is parasitic on the sawfly in England and has been introduced and liberated in Canada. The Chalcid, *Coelopisthis* (*Pteromalus*) *nematicida*, Pack., occurs in Massachusetts and probably also in Connecticut, and acts as an important check. *Diglochis* sp. parasitised from 10 to 15 per cent. of cocoons in Minnesota in 1909–10; while *Perilampus* sp. and *Microgaster* sp. have been reared from pupae in Wisconsin and New York respectively. In England, the following parasitic Ichneumons have been reared:—*Microcryptus labralis*, Grav., *Aptesis nigrocinctor*, Foers., *Spilocryptus incubitor*, Ström., *Coelichneumon fuscipes*, Grav.,

Gratichneumon annulator, F., and *Cryptus minator*, Grav. The Tachinid flies, *Frontina* (*Masicera*) *tenthredinidarum*, Towns., and *Exorista* spp. were bred in New Brunswick and England respectively. The bug, *Apateticus* (*Podisus*) *modestus*, Dall., is predaceous on the larvae in Quebec and New York, and is known to occur in New Jersey. The fungus, *Isaria farinosa*, Fr., is found on cocoons in Canada and in England, destroying the insect within. This fungus may prove an important check under favourable climatic conditions. Artificial methods of control include :—(1) spraying with lead arsenate, at a maximum strength of 3 lb. to 50 gals. water ; this method is applicable only to small areas ; (2) the collection and burning of cocoons ; (3) banding of trees with tanglefoot, etc. ; (4) the planting of other trees, especially white pine, among the larches. An infestation may occur during 1916, hence trees should be carefully watched during May, and preparations made for spraying if necessary.

WALDEN (B. H.). **Experiments in Controlling the White Pine Weevil in 1915.**—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven*, 1916, pp. 134–136. [Received 25th April 1916.]

During 1914, white pines infested with the white pine weevil (*Pissodes strobi*) were sprayed with lime-sulphur, one part in eight parts water, and with lead arsenate, 3 lb. in 48 gals., on 7th and 11th May respectively. Collections of weevils were also made with a net on several dates between 7th May and 10th June. Both in 1914 and 1915 lime-sulphur gave the best results, while in 1915 weevils were about half as numerous in trees sprayed with lead arsenate and treated with a net as in the check trees. Experiments in this direction are being continued.

The Juniper Web-Worm, *Dichomeris marginellus*, **Fabr.** — *Rept. Connecticut Agric. Expt. Sta., 1915, New Haven*, 1916, pp. 137–139, 2 figs. [Received 25th April 1916.]

Larvae of *Dichomeris marginella*, F., were found on *Juniperus communis* in several localities during May. Other records of the insect have been made in Maine and New York. The moths appear early in June. The larvae feed on dried or fresh leaves which are webbed together, and pupate in the same position. There may be more than one generation annually. In the event of a serious attack, a thorough spraying with lead arsenate while the larvae are small should prove satisfactory.

Three Species of Scale-Insects new to Connecticut.—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven*, 1916, pp. 139–140, 1 plate. [Received 25th April 1916.]

Leucaspis japonica, Ckll., was introduced into Connecticut on Norway maple and California privet during 1914. Specimens were collected in August 1915 on silver maple at New Haven. *Lepidosaphes newsteadi*, Sulz., was recorded on *Sciadopitys verticillata* (umbrella pine). This species has been described from Europe on tea and the variety *tokionis* on *Codiaeum* from Japan. *Diaspis echinocacti*, Bch., var. *cacti*, Comst., occurred on *Phyllocactus* in a greenhouse. It will probably not live out of doors in Connecticut and remedies used against other scale-insects will probably prove effective for this species.

White Grub Injury in 1915.—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven,* 1916, pp. 179–181, 2 plates. [Received 25th April 1916.]

About fifteen species of the genus *Lachnosterna* occur in Connecticut, the following being the most important economically:—*L. fusca*, Froh., *L. fraterna*, Harris, *L. hirticula*, Knoch, *L. crenulata*, Foerster, and *L. nova*, Smith. Much damage was recorded throughout the State during 1912 and again during 1915. Since the life-cycle occupies three years, further injury may be expected in 1918. The food-plants include maize, potatoes, mangels, lettuce, strawberry, etc. Cultural measures should be followed to reduce the numbers of the larvae. Ploughing and disk-harrowing in autumn should prove effective. Crops most liable to be damaged, such as maize, potatoes and strawberries, should not be grown on grass or weedy land, nor should they follow small grain in years when white grubs are expected to be abundant.

Entomological Features of 1915.—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven,* 1916, pp. 181–183. [Received 25th April 1916.]

Tent caterpillars (*Malacosoma*) were abundant during the year. Green apple aphis (*Aphis pomi*) and rosy apple aphis (*A. sorbi*) caused serious injury to fruit in some districts. The San José scale (*Aspidiotus perniciosus*) was highly parasitised and showed a decline in importance as an orchard pest. Apple maggots (*Rhagoletis pomonella*) infested early ripening varieties of apples. The cabbage maggot (*Chortophila brassicae*) was unusually abundant and caused injury to early cabbages where no control measures had been practised. Red bugs (*Heterocordylus*) in orchards appeared to be increasing. A slight decrease occurred in the amount of damage by the hickory bark beetle (*Scolytus quadrispinosus*).

Miscellaneous Insect Notes.—*Rept. Connecticut Agric. Expt. Sta., 1915, New Haven,* 1916, pp. 183–191, 1 fig., 4 plates. [Received 25th April 1916.]

Systena taeniata, Say (banded flea-beetle) caused injury to beans, tomato, egg-plant and sunflower, by feeding on the leaves. *Erranis tilaria*, Harris (lime-tree span-worm) was found on birch during June. Some of the larvae pupated on 15th June and a single adult was obtained in December. Under natural conditions eggs are laid in November and December. The insect can be checked by the use of arsenical sprays. Large numbers of *Prospaltella perniciosi*, Tower, a parasite of the San José scale (*Aspidiotus perniciosus*) were reared. *Ceresa bubalus*, F. (buffalo tree-hopper), appeared to be common, but only showed the characteristic scarring effect on apple in one locality. This insect is not affected by the usual sprays, but can be controlled by thorough cultivation, by the burning over of weedy borders in June and by the removal and burning in autumn of infested twigs. *Tortrix (Archips) rosana*, L. (privet leaf-roller), was present in one district. *Lygidea mendax*, Reut. (false apple red bug), caused considerable damage in the south-western portion of the State. As a

control measure the trees should be sprayed with Black Leaf 40, 1 pt. to 50 gals. water, with or without lead arsenate and fungicides before the blossoms open, and again just after the petals fall. A European sawfly, *Emphytus cinctus*, L., was present in the pith of the cut ends of rose stalks imported from France. The larvae pupate in this position and apparently do not bore into the plants in an injurious manner. In Europe the larva feeds on the leaves of rose and raspberry and is regarded as injurious. It can be killed by spraying the foliage with lead arsenate or hellebore. *Saperda vestita*, Say (linden borer), caused injury to lime trees by tunnelling under the bark near the base; a fungus usually followed the attack, causing the decay and breaking of the tree. This species apparently requires two years for its development. Infested trees should be examined twice a year, and carbon bisulphide injected into the burrows. Two Psyllids, namely, *Psylla buxi* and *Spanioneura fonscolombei*, occurred on twigs of boxwood; they were probably introduced from Europe on nursery stock. *Typophorus canellus*, F., (strawberry root worm) injured the leaves of strawberry, but the roots were not damaged. Normally, the first generation of adults feeds on the leaves during May, and the larvae of the next generation live in the soil, feeding on the roots and pupating in July. Adults emerging in August feed on the leaves for a time, then hibernate. A thorough spraying with lead arsenate in May and August should prevent serious damage. *Pemphigus tessellatus*, Fitch, occurred on silver maple; the tree was successfully sprayed with kerosene emulsion. Termites, probably *Leucotermes flavipes*, were recorded from one locality, where the timber of a dwelling house was infested. Chrysanthemums, marguerites and other Composites were occasionally attacked by a leaf-miner, *Phytomyza chrysanthemi*, Kow. A new leaf weevil, *Polydrusus impressifrons*, Gyll., was found under birch during June. This species is a minor pest in New York, where it feeds on the buds and young leaves of birch, poplar and willow. The Tortricid, *Tortrix albicomana*, Clem., was found on oak, and has also been reported on rose and *Aquilegia canadensis*. An early spraying with lead arsenate would prevent serious injury. *Macronoctua onusta*, Grote, was present in small numbers in the roots of iris wherever the latter was grown. The only control measure is to destroy the infested root-stock when resetting the plants. Bermuda lilies grown from bulbs imported from Japan were injured or completely destroyed by *Rhizoglyphus hyacinthi*, Boisd. (bulb mite). The mites could probably have been killed by dipping the bulbs in fir tree oil or nicotine solution. There is at present no systematic inspection of bulbs imported into Connecticut. Peaches in one locality were injured by the beetle, *Diplotaxis atlantis*, Fall., a native species which normally feeds on woodland trees. A heavy coating of lead arsenate on the buds and unfolding leaves might prevent serious damage. Beets grown for seed were infested in one locality with *Aphis rumicis*, L., *Macrosiphum solanifolii*, Ashm., and *Myzus persicae*, Sulz. Coccinellids were abundant, and many of the Aphids were parasitised by *Lysiphlebus*. The weeds, *Chenopodium album* and *Amarantus retroflexus*, were growing throughout the field. At the time of investigation, in the middle of July, treatment was useless, but it is probable that nicotine solution applied at a high pressure two or three weeks earlier would have killed most of the Aphids.

COCKERELL (T. D. A.). **Sunflower Insects in California and South Africa.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 3, March 1916, pp. 76–79.

The following insects visit or attack *Helianthus lenticularis* (sunflower) in California:—Hymenoptera: *Halictus armaticeps*, Cress., *H. nevadensis*, Craw., *H. helianthi*, sp. n., *Agapostemum texanus*, Cress., *Melissodes aurigenia*, Cress., *Pseudomelecta californica*, Cress., *Diadasia enavata*, Cress. Coleoptera: *Desmoris constrictus*, Say, *Diabrotica* sp. Lepidoptera: *Eupithecia* sp., *Pyrameis* sp. Rhynchota: *Acholla tabida*, Stål, *Lygus pratensis*, L., *Macrosiphum* sp.

The following Lepidoptera visit sunflowers in the Transvaal:—*Phytometra orichalcea*, *P. chalcytes*, *P. exquisita*, *P. oxygramma*, *Chloridea obsoleta*, *Zinckenia fascialis*, *Ulothrichopus catocala*, *Empusada chrysota*, and *Coradrena* sp.

SWAINE (J. M.). ***Platypus wilsoni*, a New Species of *Platypus* from British Columbia (Platypodidae, Coleoptera).**—*Canadian Entomologist, London, Ont.*, xlviii, no. 3, March 1916, pp. 97–100, 2 plates.

Platypus wilsoni, which is here described, attacks all species of conifers on the British Columbia coast, with the exception of *Thuya* and *Chamaecyparis*, but is most abundant in *Pseudotsuga*, *Tsuga* and *Abies grandis*. Dying or weakened trees and freshly cut logs are usually attacked, but living trees may be affected. The adults bore into the bark and wood of the host, the walls of the tunnels becoming coated with a fungus which serves as food for the larva, and in a less degree for the adult.

GIRAULT (A. A.). **Description of Eleven New Species of Chalcid Flies.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 3, March 1916, pp. 100–103.

The new Chalcidoidea described, include:—*Neomphaloidella ceroplastae*, reared from *Ceroplastes galeatus*, Newst., from Uganda; *N. pulchriventris*, from Maryland; *N. nebraskensis*, from Nebraska; *Gonatocerus partifuscipennis*, from Maryland; *Phaenodiscus partifuscipennis*, bred from *Saissetia hemisphaerica* in California; *Sympiesomorphellus trisulcus*, from St. Vincent.

WEISS (H. B.). **A New Enemy of Poplars and Willows in New Jersey.**—*Canadian Entomologist, London, Ont.*, xviii, no. 3, March 1916, pp. 105–106.

The Chrysomelid, *Plagiodera versicolor*, Laich., has done considerable damage during the past few summers to poplars and willows in several districts in New Jersey. It is probable that both the larval and adult stages can be kept in check by the use of arsenical sprays.

NOTICES OF ENTOMOLOGICAL APPOINTMENTS, &c.

Dr. ALFRED E. CAMERON, formerly of the Department of Agricultural Entomology, Victoria University, Manchester, has taken up duties in the Entomological Branch, Department of Agriculture, Ottawa, Canada.

Messrs. A. J. GROVE and L. HARRISON have been appointed by the War Office to advise on Entomological problems in connection with the military operations in Mesopotamia.

The services of Dr. W. A. LAMBORN have been lent by the Imperial Bureau of Entomology to the War Office and he is now attached to the Expeditionary Force in East Africa.

Mr. C. B. WILLIAMS has been appointed by the Board of Agriculture, Trinidad, to study the parasites of the Sugar-cane Froghopper in that island.

SWAINE (J. M.). **Injurious Shade Tree Insects of the Canadian Prairies.** —*Agric. Gaz. Canada, Ottawa*, iii, no. 3, March 1915, pp. 215-220, 8 figs.

The Manitoba maples, cottonwoods, poplars and willows, so widely used in the prairie provinces of Canada for shade and shelter belts, are subject to attacks by very injurious insect enemies. Such outbreaks were unusually severe during the summer of 1915. Poplars and willows are frequently attacked by several leaf-eating beetles, including *Galerucella decora*, Say (western willow leaf-beetle), *Melasoma* (*Lina*) *scripta* (streaked cottonwood leaf-beetle), *M. tremulae* (unspotted aspen leaf-beetle) and several allied species. Both adults and larvae of *G. decora* feed upon the leaves, more or less completely destroying the foliage and leaving the trees scorched and brown. The other species have similar habits and frequently cause the same injury. *M. scripta* and a closely allied species, *M. interrupta*, seriously injured windbreaks of willows in the summer of 1915 in Saskatchewan and Alberta. Spraying with lead arsenate or Paris green as soon as the beetles appear, and again, if necessary, about ten days later, is an efficient control. *Alsophila pometaria*, Harris (fall cankerworm) was particularly injurious to Manitoba maples in Manitoba and Saskatchewan in 1914 and 1915. The females, being wingless, crawl up the trunks to deposit their eggs. The adult caterpillars descend and pupate in the ground. The adult emerges in the autumn and the females oviposit upon the bark of the branches and twigs. The eggs hatch late in April, or in May, and the caterpillars feed upon the foliage for about a month. Serious defoliation results if they are very numerous. The moth of *Palaeacrita vernata*, Pack. (spring cankerworm) emerges from the ground and deposits its eggs upon the bark in small clusters during the first warm days of spring. Banding the trees to prevent the ascent of the females or spraying with Paris green or lead arsenate as soon as the caterpillars appear are the controls recommended. *Chaitophorus negundinus*, Thos. (Negundo Aphis) is the most persistent and serious enemy of Manitoba maples in the prairie provinces, inducing the rapid development of a black sooty fungus, and sometimes causes considerable defoliation. Usually the many insect enemies of this pest so reduce its numbers that the trees may develop normally through the latter half of the season. Kerosene emulsion, fish oil or whale oil soap and the nicotine extracts are effective. *Proteopteryx willingana*, Kearf. (Negundo twig-borer) is more or less injurious each season to twigs of the Manitoba maple. The caterpillar bores into the young twigs, causing them to develop into elongated hollow galls within which the caterpillar lives and feeds, extruding the excrement through a hole in the side. The caterpillars reach full growth in June and pupate either in the ground beneath the trees or, less frequently, within the galled twigs. The only control which has been suggested is to collect and burn infested twigs, but it is possible that a spray of Paris green or lead arsenate applied about the end of June would destroy many of the young caterpillars. *Saperda calcarata* (poplar borer) is a common and destructive enemy of all kinds of poplars. Rough, blackened scars and swollen areas on the trunk and branches, with large tunnels piercing the wood beneath, are evidences of its work. The eggs are laid in the bark of poplars during the latter part of the summer. The whitish grubs feed first in the inner bark and then bore

(C275) Wt P1/106. 1,500. 7.16. B.&F.Ltd. G.11/2. A

into the wood below; they attain a length of two inches when full-grown and excavate large irregular tunnels through the sap-wood and heart-wood. The tunnels are often betrayed by the castings extruded from openings in the bark. Infested trees of little value should be removed and burned before June. Valuable trees may be saved by cutting out the boring grubs in the early autumn, or by killing them with injections of benzine or carbon bisulphide. *Leptocoris trivittatus*, Say, (box elder plant bug) is often found congregating in immense numbers about houses and out-buildings in the warm days of late autumn. During the early part of the season they breed upon the foliage of the Manitoba maple and other trees and are seldom very conspicuous. The gregarious habit appears only during the latter half of summer. Dense masses may be destroyed with boiling water or by spraying with kerosene. Suitable screens upon the windows and doors are most effective in keeping them from dwelling houses. This article also gives instructions regarding spraying apparatus and formulae for the sprays mentioned.

NOWELL (W.). **Some New Entomogenous Fungi in St. Vincent.**—*Agric. News, Barbados*, xv, no. 363, 25th March 1916, p. 110.

Early in 1915 Mr. W. N. Sands found a fungus, apparently a new species of *Cordyceps*, in the Botanic Gardens, Kingstown, where it was growing on the larvae of the beetle, *Cryptorrhynchus corticalis*, Boh., boring the wood of *Codiaeum variegatum* (common croton). The affected larvae are found in their tunnels in the stems, retaining their form and colour, but converted into hard sclerotia. On 1st January 1916 the author found, in the soil near the roots of a cacao tree at Mount William estate, a dead grub having the larval characters of *Diaprepes* and *Exophthalmus*, the common root-feeding weevils in the West Indian islands. In the laboratory, a fungus of the genus *Isaria* developed from this. Messrs. Sands and Harland have had under observation for some months a fungus found on *Heliothrips rubrocinctus*, Giard, infesting cacao leaves. It has the appearance of being parasitic on this insect, being found on larvae as well as adults. It is said to have been seen in such abundance as to justify its being regarded as a considerable factor in the control of this pest. During a visit to Queensbury estate in January 1916, the author observed a slate-grey fungus extending over considerable areas of pigeon pea, which were heavily attacked by *Aulacaspis pentagona*, Targ. The fungus closely resembles *Septobasidium pedicellatum*, Schwein., common in St. Lucia on colonies of the purple scale (*Lepidosaphes beckii*) on citrus trees, and will probably prove to be that species. It appears not to have been previously recorded in St. Vincent. The same remark applies to the fungus, *Ophionectria coccicola*, E. & E., which was found on the same occasion growing on scale-insects infesting lime trees. The circumstances of its occurrence under very sheltered conditions suggest that its non-development in other districts is due to insufficient humidity rather than to actual absence. Another fungus, an *Aschersonia* found on the purple scale at Queensbury, appears to be quite new to these islands. *Sphaerostilbe coccophila*, Tul. (red fungus) and *Myriangium duriaei*, Mont. (black fungus) were also present in abundance.

BRITTON (W. E.) & LOWRY (Q. S.). **Insects attacking cabbage and allied crops in Connecticut.**—*Conn. Agric. Expt. Sta., New Haven*, Bull. no. 190, January 1916, 23 pp., 17 figs. [Received 25th April 1916.]

This paper embodies the observations of many years on cabbage pests and on the control of *Chortophila* (*Phorbia*) *brassicae*, Bch. (cabbage root maggot). Tarred paper disks are recommended as the best control for this pest and figures are given of a tool and a device for cutting these disks. Perhaps the second most effective control method is to pour into a surface depression round the stem of each plant about three fluid ounces of crude carbolic acid emulsion made according to the following formula: Hard soap, 1 lb., or soft soap, 1 U.S. qt., boiling water, 1 U.S. gal.; crude carbolic acid, 1 U.S. pt. The other pests dealt with are *Pieris rapae*, L., (imported cabbage worm), *P. napi*, L. (potherb butterfly), *P. protodice*, Boisd. (southern or checkered cabbage butterfly), *Phytometra* (*Autographa*) *brassicae*, Riley (cabbage looper), *Aphis brassicae*, L. (cabbage aphis), *Plutella maculipennis*, Curt., *Ceramica* (*Mamestra*) *picta*, Harr. (zebra caterpillar), *Murgantia histrionica*, Hahn. (harlequin cabbage bug), cut-worms and wire-worms. Crop rotation is an essential control measure, care being taken to avoid closely related crops in carrying this out. Cabbage stumps, leaves, etc., should not be allowed to remain in the rows, as they provide hibernating places. Late autumn ploughing destroys a great many hibernating insects; for cut-worms, early spring ploughing and harrowing is advised. A bibliography is given of twenty of the more important publications dealing with insects injurious to cabbages.

GODARD (A.). **Les oiseaux peuvent-ils sauver la vigne?** [Can birds save the vine?]—*Rev. Viticulture, Paris*, xliv, no. 1137, 13th April 1916, pp. 278–280.

Cases are instanced where the presence of birds resulted in a notable diminution of loss from the insect enemies of the vine. The presence of *Clysia ambiguella* and *Polychrosis botrana*, as well as of other pests, is said to be exclusively due to the disappearance of insectivorous birds. Many species of birds only attack plants when insect food is lacking and in any case the partial loss due to birds is preferable to the considerable one due to insect injury. Buffon is quoted as saying: "The ortolan does not touch grapes, but feeds on the insects which creep on the stocks and leaves of the vine." It must however be borne in mind that all species of birds are not equally useful in the vineyard.

RABATÉ (E.). **Préparation des bouillies cupriques.** [The preparation of cupric sprays.]—*La Vie Agric. et Rur., Paris*, vi, no. 16, 15th April 1916, pp. 284–287, 1 fig.

This paper briefly reviews the various cupric sprays used by vine-growers. It is stated that most of the commercial solutions known as Bordeaux mixtures have carbonate of soda as their base.

Degrully (L.). **Les Bouillies acides peuvent produire des brûlures.** [Acid sprays may cause scorching.]—*Progrès Agric. Vitic., Montpellier*, lxv (33rd year), no. 16, 16th April 1916, pp. 365–367.

While acid sprays are generally considered to be more effective, they are more apt to scorch than the neutral or alkaline. For a spray containing 2 per cent. of copper sulphate (2 parts by weight to a 100 parts by weight of water) a table of liability to cause injury is given of five sprays containing a constant proportion of copper sulphate, namely 2 per cent. by weight, but in which the carbonate of soda (90° purity) content is diminished regularly from 0·90 to 0·75 per cent. With 0·900 there results a neutral solution which never scorches; with 0·875 a slightly acid solution is produced which seldom scorches, or, if it does so, the injury is negligible; with 0·850 a medium-acid spray is obtained which is inoffensive after flowering, but may scorch before and during flowering; with 0·800 a markedly acid solution is produced which should only be used after flowering; lastly, with 0·75 a very acid solution is yielded which can only be used after flowering where it is absolutely necessary to spray even at the risk of serious scorching. These data are approximate. Where carbonate of other purity is used it is necessary to make due allowance.

Degrully (L.). **Chaux en pierres et Chaux blutée.** [Stone lime and sifted lime.]—*Progrès Agric. Vitic., Montpellier*, lxv (33rd year), no. 16, 16th April 1916, p. 367.

Fat stone lime, recently slaked, is considered the best for preparing Bordeaux mixture; it is only slightly carbonated, its reaction on copper sulphate is rapid, and the operator readily notes the approximate moment of neutralisation. It is, however, often necessary to use commercial sifted lime, which is more or less carbonated according to the date of manufacture, the content of pure lime being very variable.

Baker (A. C.) & Turner (W. F.). **Some Intermediates in the Aphididae (Hemiptera).** — *Proc. Entom. Soc. Washington, Washington, D.C.*, xviii. no. 1, March 1916, pp. 10–14.

Among the species described in this paper, *Macrosiphum viticola*, Thos., *Aphis avenae*, F. (*Aphis prunifoliae*, Fitch) and *A. sorbi*, Kalt. (*A. malifoliae* Fitch) have been studied throughout the complete life-cycle. They have annual cycles and alternate hosts. In the first two species the intermediates occur on the summer hosts and are intermediates between summer apterae and summer alates. *A. sorbi* winters on apples and passes the summer on *Plantago* spp., especially on rib grass. The intermediates of this species occurred on apple, and were intermediate between alates which cannot live on apple but must migrate to plantain and apterae which feed only on apple. The intermediates lived and reproduced on apple, thus assuming the nature of the primary apterous forms. The following species are also described:—*Aphis gossypii*, Glover, on melon; *Phyllaphis fagi*, L., on beech; *Myzus persicae*, Sulz., on cabbage; *Eriosoma* sp., on pear.

Kotinsky (J.). The European Fir Trunk Bark Louse (*Chermes (Dreyfusia) piceae*, Ratz.) apparently long established in the United States.—*Proc. Entom. Soc. Washington, Washington, D.C.*, xviii, no. 1, March 1916, pp. 14–16.

Chermes piceae has caused the death of considerable numbers of balsam firs in New Haven during the past three years. Records of injury by this insect show that it has been in the country for at least seven years. In Europe both *C. piceae* and *C. nüsslini* are practically confined to firs and are presumed to have an alternate host. The former species hibernates on the bark as the larval stem-mother. Activity is resumed in spring, maturity being reached in April, when oviposition takes place. The eggs hatched during May develop into summer stem-mother or winter stem-mother larvae which settle on the old bark, the latter forms not completing growth until the following spring. The former reach maturity between May and July and deposit a small number of eggs, which develop into winter stem-mother larvae. Part of the summer larvae become winged migrants which fly during May or June to *Picea excelsa*. They there lay eggs which become sexual forms. In America, only the winter larva has been observed. It is possible that the death of many fir trees in Europe may have been partly due to *C. nüsslini*, since the records were made before the distinction between the two species was recognised.

Proclamation concerning the Importation of Plants into Australia.—Extract from *Commonwealth of Australia Gaz., Melbourne*, no. 158, 23rd December 1915. [Received 1st May 1916.]

The introduction into Australia of the following plants is forbidden, unless certified by the Chief Quarantine Officer to be free from insect or fungus pests :—(1) All plants, including fruit and seed (other than manufactured products), liable to infestation by *Hemileia vastatrix*, from Ceylon, India, China, Malay Peninsula, etc. ; (2) sugar-cane and banana plants, exclusive of the fruit of the latter, grown in New Guinea, Sandwich Islands, Fiji, etc., where they may be attacked by *Sphenophorus* sp.

French, Junr. (C.). An insect pest of lucerne: Cockchafer grubs (*Heteronyx piceus*, Blanch.).—*Jl. Dept. Agric. Victoria, Melbourne*, xiii, no. 9, 10th September 1915, pp. 567–569, 2 figs. [Received 1st May 1916.]

Lucerne-growers at Werribee have suffered considerable losses from the attacks of the grubs of *H. piceus*, which live on the roots of native and other grasses and seem to confine themselves to particular patches of the soil, usually where manure has been rather plentifully used. The exceptionally dry season in 1915 favoured this pest ; in very wet seasons many of the grubs are destroyed by a fungus disease. When a lucerne crop is badly affected, it is advisable to have it cross-scarified, if practicable, harrowed and then rolled. These methods gave very satisfactory results at Werribee. Keeping the ground continually worked is absolutely necessary, as it exposes the grubs to the attacks of birds, of which the most useful are seagulls, robins,

magpies, plovers, etc. These grubs have been recently reported to attack wheat, generally in patches. The use of a poisoned bait, consisting of lucerne, grasses, succulent weeds, etc., cut up into small pieces and dipped in lead arsenate (1 lb. to 30 gallons of water), is suggested. If only small patches are affected, watering the plants with lead arsenate will give good results. Some species of *Heteronyx* cluster on the tops of eucalyptus trees, often stripping them of every young leaf.

FRENCH, Junr. (C.). **The potato-moth *Phthorimaea operculella*, Zeller (*Lita solanella*, Bois.); Recent spraying experiments in Gippsland.**—*Jl. Dept. Agric. Victoria, Melbourne,* xiii, no. 10, 11th October 1915, pp. 614-618, 2 figs. [Received 1st May 1916.]

Phthorimaea operculella has been known in Australia since 1854 and is the worst potato pest in the Commonwealth. Owing to the exceptionally dry weather, it has been very plentiful during the past two seasons and in Gippsland and elsewhere the injury has been very great. In some cases the whole crop was destroyed when the plants were from 4 to 6 inches high, and in many instances growers had to discard fully two-thirds of the tubers owing to the depredations of the caterpillars. There are two broods of moths. The first, or winter brood, may destroy the young plants and thereby ruin the crops. The moths of the second brood deposit their eggs on the potatoes themselves, when the tubers are stored or are in the field. Details of the life-history are given. It is pointed out that a few handfuls of potato plants are frequenty thrown over the top of a sack containing newly dug potatoes. If the plants are infested and the sack is left in the field for a few days, the caterpillars will be distributed throughout its contents. Spraying with lead arsenate is advisable when the moths first appear. As a deterrent against oviposition on the plants, coal-tar water may be used. The formula is as follows: 1 lb. of coal-tar is boiled in 2 gals. of water and, while hot, from 50 to 100 gals. of water are added. In cases where spraying is to be carried out, spaces should be left between every few rows of potatoes for the horse drawing the spraying pump to pass. The pump recommended is a barrel-pump mounted on two wheels; at the rear a rod twice as long as the axle supports five spray-nozzles at about the height of the axle and another five almost at ground-level. Such a pump costs £35 with iron droppers and £37 10*s.* with copper ones. Owing to potato-growers neglecting to keep the moth in check, potato spraying should be made compulsory.

DUDGEON (G. C.). **Egyptian Agricultural Products.** *Sorghum vulgare*, **Pers.** (*Andropogon sorghum*, **Brot.**), **the Great Millet (Durra Baladi in Egypt), also** *Sorghum halepense*, **Pers. (Garawao).**—*Ministry of Agric., Egypt, Cairo,* no. 1a, 1915, 32 pp. [Received 1st May 1916.]

This paper gives an account of the cultivation and uses of *Sorghum vulgare* and *S. halepense*. The first-named is attacked by *Sesamia cretica*, the eggs of which are probably laid on the stem close to the ground. The larvae, upon hatching, bore into the stalk and may cause the death of the plant. A tunnel is frequently formed reaching

into the fruiting head, in which the larva may remain during the winter. When first sprouting, the plants may be attacked by the cutworms, *Agrotis ypsilon* and *Euxoa spinifera*. Control measures include early threshing of the grain for the destruction of larvae of *S. cretica* and rolling the ground and mixing naphthaline with the seed at sowing time for reducing the number of cutworms. *Aphis sorghi* causes occasional local damage. Honey-dew is secreted by this Aphid which favours the growth of a fungus. Two predaceous enemies of *A. sorghi* occur in Egypt, namely, *Chilomenes vicina*, Muls., and *Coccinella undecimpunctata*, L.

DUDGEON (G. C.). **Egyptian Agricultural Products. *Arachis hypogaea*, Lin., the Ground Nut, or Earth Pea (Fûl Sudani in Egypt).**—*Ministry of Agric., Egypt, Cairo*, no. 2a, 1915, 24 pp. [Received 1st May 1916.]

Arachis hypogaea, the cultivation of which is described, has no very serious insect or fungoid pests in Egypt. *Prodenia litura* (cotton worm) may become abundant at intervals in Lower Egypt, and at such times the crop is seriously damaged. A yellow Aphid occurs on this plant in Fayûm and Wardan, especially in the latter district during August, but infestation is not usually severe.

Dealing with the Banana Borer in Jamaica.—*Daily Gleaner, Kingston, Jamaica*, 21st March 1916, pp. 13-14. [Received 2nd May 1916.]

At a meeting of the Jamaica Agricultural Society held to consider the question of the banana weevil, the report of the special committee appointed to investigate the problem was adopted. *Cosmopolites sordidus* occurs in well-defined areas in Jamaica. The Director of Agriculture considers the weevil to have been present in the island for many years and to be widely distributed, and further to be incapable of becoming a serious menace to the banana industry. In his opinion good cultivation should prevent attack, and he recommends the introduction of a predatory beetle enemy from Java. The committee, on the other hand, believe that this pest is not indigenous to, or of long standing in Jamaica and that the attack is so serious that immediate action is required to check its spread. Injury is not confined to poor or rotting bananas, but healthy trees of any age are attacked. The rapid increase of this borer in Fiji is referred to. The committee recommend that the Governor be appealed to, to adopt the following measures:—(1) to declare *C. sordidus* a notifiable pest under the Plants Protection Law; (2) to request the Director of Agriculture to furnish a list of plantations to which suckers have been sent from Hope and Castleton Gardens, in order that immediate investigations may be made; (3) to declare all areas on which the weevil is found to be infected.

The special report of Mr. H. N. Ridley, directing the investigations of the committee, gives an account of the distribution of the borer in Jamaica; this distribution negatives the theory of the Director of Agriculture. The following suggestions are made for preventing the spread of the weevil:—(1) Destruction of infested suckers; (2) planting of infested land with cane or bush for a few years; (3) planting or encouragement of bush between slightly infested or clean land

Black Borer Beetle which is attacking Banana Trees.—*Daily Gleaner, Kingston, Jamaica*, 22nd April 1916, p. 6.

An investigation is being made as to the areas in Jamaica in which *Cosmopolites sordidus* occurs, so that these districts may be declared infested and an order issued making this insect a notifiable one. It is proposed to introduce from Fiji the Histerid beetle, *Plaesius javanus*, Er., which is predaceous on this weevil.

Dash (J. S.). **Report of the Assistant Superintendent of Agriculture on the Entomological and Mycological Work carried out during the Season under Review.**—*Rept. Dept. Agric., Barbados, 1914–15*, *Barbados*, 1916, pp. 38-44. [Received 4th May 1916.]

The inspection of imported seeds and plants was continued during the year. A species of scale-insect not previously recorded in Barbados was found on mango brought from St. Lucia. Cotton seed intended for the extraction of oil was fumigated with sulphur dioxide, while seed used for planting was treated with carbon bisulphide.

The insect pests noted during the year were:—Sugar-cane. *Diaprepes abbreviatus*, L. (root borer) caused much damage in low-lying districts. Fields in which crop rotation had not been practised showed signs of the borer in April, while in fields which had not been planted with cane for consecutive years, the injury was almost negligible. In one case the larvae were found attacking yams. In the experimental plots the insect was found on all the black soil estates, and it was observed that the emergence of the beetles in April and June followed periods of rainfall. *Phytalus smithi* (brown hardback) showed a greater degree of parasitism by *Tiphia parallela* than in the preceding year. A consignment of *Tiphia* cocoons was sent to Mauritius and the work of transferring the parasites to St. Michael to control *P. smithi* was continued whenever material was available. *Delphax saccharivora* (cane-fly) was found for the first time to be parasitised by the Mymarid, *Anagrus flavescens*, Waterh. *Diatraea saccharalis* (moth borer) was present in some estates. It is probable that the collection of egg-masses, together with provision of facilities for the escape of the parasites from these, would considerably reduce the numbers of the moth. *Pseudococcus calceolariae* (pink mealy bug) was found on old canes; on one estate this scale was kept in check by a fungus, *Aspergillus* sp. *Exophthalmus esuriens*, Gyl., showed no signs of spreading, and could not be regarded as injurious. *Leucotermes tenuis* and *Calotermes* sp. were recorded during the year.

Cotton. Cotton pests were not very abundant; *Alabama argillacea* appeared in many fields, but was easily controlled and *Eriophyes gossypii* (leaf blister mite) did not cause serious damage.

Maize. The most important pests were *Laphygma frugiperda* and *Pyroderces stigmatophora*.

Sweet potatoes. *Euscepes batatae* was the most serious pest; thrips and flea-beetles were recorded on one estate during December.

Fruit trees. Trees in a neglected citrus orchard were affected by the following scales:—*Lepidosaphes beckii, Chionaspis citri, Chrysomphalus aurantii* and *Coccus viridis*. The last-named species was parasitised by the fungus, *Cephalosporium lecanii*. Bark-borers, probably *Leptostylus praemorsus*, caused injury to grape-fruit in one district.

Miscellaneous insects. Bengal beans were seriously damaged by the larvae of the moth, *Anticarsia* (*Thermesia*) *gemmatalis*; dusting with lead arsenate was found to prove effective. *Mocis* (*Remigia*) *repanda* (grass moth) was prevalent. Lignum vitae trees suffered from attacks of the larvae of the Noctuid, *Gerespa fasciolaris*. The larvae fed on the leaves at night, remaining hidden during the day. A related form, *G. famelica*, was frequently collected during the day time. Other Noctuids collected during the year were *Prodenia dolichos*, *Feltia malefida*, *F. subterranea* and *Phytometra oo*, on cotton and sweet potatoes, *Xylomyges sunia* on *Zephyranthes*, and *Cirphis multilinea*. The Cossid, *Duomitus punctifer* and *Diaphania hyalinata* (melon moth) were common. Certain Coccinellids, including *Cycloneda sanguinea*, *Megilla maculata* and *Scymnus ochroderus*, as well as the Nitidulid beetle, *Carpophilus mutilatus*, were effective in controlling Aphids on maize. The Sphegid wasp, *Tachytes argentipes*, was found during May and June on maize, castor oil and okra brushes, etc. *Notogonia luteipennis* was less common than the preceding species. In India species of both these genera are beneficial insects, in that they prey on crickets, and it is possible that in Barbados they have similar habits.

A list of COCCIDAE occurring in Barbados is given, the food-plants being numerous where no special host is mentioned. *Aspidiotus cydoniae*, Comst., on grape vine and *Canavalia*; *A. destructor*, Sign.; *A. hartii*, Ckll., on yam and eddoe; *A. sacchari*, Ckll., on sugar-cane; *Chrysomphalus aurantii*, Mask., on citrus; *C. biformis*, Ckll., on orchids, *Yucca*, and *Euphorbia*; *C. bowreyi*, Ckll., on agave; *C. dictyospermi*, Morg., on roses and palms; *C. aonidum*, L.; *C. personatus*, Comst.; *Selenaspidus articulatus*, Morg.; *Pseudaonidia tesserata*, de Charm., on grape vine, *Cassia fistula* and *Cissus sicyoides*; *Asterolecanium aureum*, Boisd., on eucharis lily; *A. bambusae*, Boisd., on bamboo; *A. miliaris*, Boisd., on bamboo; *A. pustulans*, Ckll.; *Ceroplastes cirripediformis*, Comst.; *C. dugesii*, Licht., on *Bursera gummifera* and *Coccoloba uvifera*; *C. floridensis*, Comst.; *Howardia biclavis*, Comst., on *Tabernaemontana*; *Chionaspis citri*, Comst., on citrus; *C. unilateralis*, Newst., on palm; *Hemichionaspis minor*, Mask.; *Conchaspis angraeci*, Ckll., on imported *Epidendrum* and *Stephanotis*; *Pseudococcus adonidum* L. (*longispinus*, Targ.); *P. calceolariae*, Mask., on sugar-cane; *P. citri*, Risso; *P. pseudonipae*, Ckll., on coconut; *P. nipae*, Mask., on imported *Phoenix*; *P. sacchari*, Ckll., on sugar-cane; *P. virgatus*, Ckll.; *Aulacaspis pentagona*, Targ.; *A. rosae*, Bch., on mango; *Diaspis boisduvalii*, Sign., on coconut; *D. calyptroides*, Costa (*D. echinocacti*, Bch.), on imported *Melocactus*; *Fiorinia fioriniae*, Targ., on coconut; *Ischnaspis longirostris*, Sign.; *Saissetia depressa*, Targ., on *Coleus* and *Furcraea*; *S. hemisphaerica*, Targ.; *S. nigra*, Nietn.; *S. oleae*, Bern.; *Coccus hesperidum*, L., on *Sterculia fulgens* and *Pluchea odorata*; *C. longulus*, Dougl.; *C. mangiferae*, Green; *C. viridis*, Green; *Eucalymnatus tesselatus*, Sign., on palms; *Lecanium vacuolatum*, Green, sp. n., on *Anthurium*; *Margarodes formicarium*, Guild., on sugar-cane; *Lepidosaphes beckii*, Newm., on citrus; *L. gloveri*, Pack., on *Croton*, and citrus; *Pinnaspis buxi*, Bouché; *Coccomytilus* ? sp. on cassava; *Orthezia insignis*, Dougl.; *O. praelonga*, Dougl.; *Pulvinaria pyriformis*, Ckll.; *P. ficus*, Hemp.; *P. simulans*, Ckll., on genip; *P. urbicola*, Ckll., on sweet potato, etc.; *Vinsonia stellifera*, Westw.

Insect Pests in British Guiana.—*Agric. News, Barbados*, xv, no. 364, 8th April 1916, pp. 122–123.

This paper gives a summary of a chart dealing with insect pests, recently issued by the Board of Agriculture of British Guiana. The origin of insect pests, the life-cycle of common forms, and the usual methods of control are dealt with in a popular manner. Special reference is made to insects occurring in the Colony.

Nowell (W). **The Internal Diseases of Cotton Bolls.**—*Agric. News, Barbados*, xv, no. 364, 8th April 1916, pp. 126–127.

Experiments carried out in Montserrat to determine the connection between cotton stainers and cotton boll disease showed that *Nezara viridula* (green bug) is capable of originating the disease in healthy plants. The spores of the specific fungus are either carried by, or follow upon the attacks of plant-feeding bugs. The fungus concerned has been found in material from Tortola, St. Kitts, Monserrat, St. Vincent and Barbados. The fact that the amount of stained of cotton is not in proportion to the number of insects present, indicates the necessity for taking the fungus into account, since it is probable that the disproportion is due to the effect of prevailing conditions upon the latter.

Report on Silk from Trinidad.—*Bull. Dept. Agric., Trinidad and Tobago, Port-of-Spain*, xv, no. 2, 1916, pp. 67–69.

The examination of silk from *Bombyx mori* (mulberry silkworm), *Attacus ricini* (eri worm) and *A. hesperus* (native silkworm), reared in Trinidad, has shown that silkworms can in all probability be successfully bred in the island. It might therefore be possible to establish silk-culture as a village industry. The following species also are reported on:—*A. cynthia* (Ailanthus silk moth of northern China and Japan), *Antherea pernyi* (Mongolian oak-feeding silkworm), *Telea polyphemus* and *Callosamia promethea*. Preliminary experiments have shown that *A. cynthia* and *A. pernyi* can be reared in Trinidad. The silk from *A. hesperus* is of poor quality and the larvae bear irritating hairs which might seriously affect the workers. Hence it seems advisable that attention should be first directed to *B. mori* and *A. ricini*, as the silk from these is good and the food-plants grow well in the island. *A. ricini* may prove the more suitable of the two species, since it can withstand a high temperature and the silk is more easily handled.

Ball (E. D.). **New Species of *Eutettix* and *Phlepsius* (Homoptera).**—*Canadian Entomologist, London, Ont.*, xlviii, no. 4, April 1916, pp. 124–130.

The new leaf-hoppers described are:—*Eutettix columbiana*, from Washington; *E. nevada*, from Nevada; *E. rubida*, from Utah; *E. insana* var. *coronata*, var. n., from California; *E. coloradensis* var. *visalia*, var. n., from California; *Phlepsius loculatus*, from California and Utah; *P. stellaris*, from Utah.

GIRAULT (A. A.). **Description of Eleven New Species of Chalcid Flies.** —*Canadian Entomologist, London, Ont.*, xlviii, no. 4, April 1916, pp. 113–116.

The following new Chalcids are described :—*Baoanusia africana*, parasitic on *Saissetia* (*Lecanium*) *oleae* in Cape Colony; *Catolaccus perdubius*, reared in connection with the strawberry weevil in Minnesota; *Hyssopus thymus*, gen. et sp. n., from Nebraska; *Pirene marylandica*, from Maryland.

HOOD (J. D.). **A New *Physothrips* (Thysanoptera) from Uganda, with a Note on *Physothrips antennatus*, Bagnall.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 4, April 1916, pp. 130–132, 1 fig.

Physothrips xanthocerus, sp. n., is described and compared with *P. antennatus*, Bagn. It was taken on coffee in Uganda.

WEISS (H. B.). **Notes on Some Miscellaneous Economic Insects found in New Jersey.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 4, April 1916, pp. 141–143.

Eriopus (*Callopistria*) *floridensis*, Guen., which causes considerable damage to ferns in greenhouses, can be controlled by spraying with fresh pyrethrum, 1 oz. to 1 gal. water, with ½ oz. soap. The chrysanthemum fly, *Phytomyza* (*Napomyza*) *chrysanthemi*, Kowarz, mines in the leaves of greenhouse chrysanthemums and may cause a reduction in the number and size of the flowers. Nicotine spray is a satisfactory remedy. The Longicorn, *Oberea tripunctata*, Swed., is widely distributed in New Jersey, but seldom in sufficient numbers to cause any serious damage. Its presence can be detected by the withering of the leaves at the tip of infested shoots. *Hemichionaspis aspidistrae*, Sign., on aspidistra and the lower leaves of fern can only be removed by the destruction of infested parts. The Chalcid, *Isosoma orchidearum*, Westw., is found in all orchid houses in which *Cattleya* spp. are grown. Development and pupation takes place within the bud, the latter finally becoming more or less swollen. Fumigation with nicotine extracts to kill the adults is the most efficient method of control. During June 1915, pine trees at Elizabeth were found to be infested by a froghopper, *Aphrophora parallela*, Say, but no injury to the trees could be detected. The larvae of *Retinodiplosis* (*Cecidomyia*) *resinicola*, O. S., were observed on the undersides of pitch-pine branches in the same locality, but no apparent damage was caused. *Corythuca arcuata*, Say (lace bug) occurs on the leaves of oak and other trees every summer in various parts of the State. In some seasons it is sufficiently abundant to cause withering of the foliage.

HOLLINGER (A. H.). ***Aspidiotus ulmi*, Johns.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 4, April 1916, pp. 143–144.

Aspidiotus ulmi, Johns, is recorded on the following plants in Missouri :—*Catalpa catalpa*, *Ulmus* sp., *Ptelea trifoliata* and *Juglans nigra*. The scales were abundant on all except *P. trifoliata*, where they occurred only at the extremities of the twigs. *P. trifoliata* and *J. nigra* have not been previously recorded as host plants.

SANDERS (G. E.). **Arsenate of Lime in Combination with Soluble Sulphur as a Spray Material for the Apple.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 4, April 1916, pp. 305–307.

During 1915 a large number of spray materials and combinations of them were tested at the Dominion Entomological Laboratory, Bridgetown, N.S. Among these was a sodium sulphur combination containing 56 per cent. sodium polysulphide sold under the trade name of "soluble sulphur." It was tested as a summer spray on apples in combination with lead arsenate, with which it almost invariably produced very severe scorching of the foliage. When tested in the laboratory, the addition of acid or hydrogen arsenate of lead to soluble sulphur resulted in the very rapid formation and precipitation of lead sulphide and the consequent formation of sodium arsenate in solution. With the addition of the neutral or tri-plumbic lead arsenate, the formation of lead sulphide and sodium arsenate proceeded much more slowly, and at a diminishing rate. With the addition of arsenate of lime, no change was apparent; the affinity of calcium for arsenic was so much stronger than that of sodium for arsenic that there was no apparent chemical alteration. As scorching seldom occurs when soluble sulphur is used alone as a spray, while the contrary is the case when it is combined with lead arsenate, it was decided to test the mixture of arsenate of lime and soluble sulphur for its scorching effect. A table of results is given. A mixture of arsenate of lime, ¾ lb. to 40 gals., and soluble sulphur, 1 lb. to 40 gals., caused practically no scorching on apple foliage. The season of 1915, on account of the high winds and excessive moisture, gave rise throughout the Annapolis Valley to more scorching from lime-sulphur than had previously occurred. Foliage sprayed with lime-sulphur and Bordeaux mixture, even where not scorched, had a dwarfed and pale appearance. With the soluble sulphur, while many leaves were scorched at the tip or edge, the unscorched portions of the leaves were exceptionally dark green and healthy. In one orchard where the mixture of soluble sulphur and arsenate of lead was used without scorching, the filling station was within 25 yards and the material was put on the trees before the change to lead sulphide and sodium arsenate had gone very far. In another orchard the owner sprayed one-half of his tank of soluble sulphur and arsenate of lead as soon as it was mixed, with very little scorching; a breakdown in the pump caused a delay of 24 hours in using the remainder, with the result that the trees thus sprayed were practically defoliated. A frequent mistake made in using soluble sulphur is to allow the sodium sulphide crystals to come in contact with the air. Contact with oxygen causes a change to sodium thiosulphate, which is valueless as an insecticide or fungicide. This change is indicated by a change in colour from yellowish green to yellowish grey. This evidence, and the fact that there is a marked difference in the action of neutral or tri-plumbic lead arsenate and hydrogen or acid lead arsenate on soluble sulphur, may account for the varied results which have been obtained with this material.

NAGANO (K.). **Life-History of some Japanese Lepidoptera containing New Genera and Species.**—*Bull. Nawa Entom. Laboratory, Gifu*, no. 1, February 1916, pp. 1-27, 9 plates. [Received 4th May 1916.]

This paper records the food-plants of a number of Japanese Lepidoptera. These include various fruit trees, but the economic importance of the insects concerned is not stated.

CULBERTSON (G.). **A New Enemy of the Black Locust.**—*Proc. Indiana Acad. Sci.. 1914, Indianapolis*, 1915, pp. 185-186. [Received 2nd May 1916.]

Black locust trees in southern Indiana were attacked, during June and July 1914, by the Hispid beetle, *Chalepus dorsalis*. The eggs of this species are deposited late in April or early in May and by 20th May the larvae can be observed mining in the mesophyll of the leaf. Pupation occurs in the same position. The adults, which emerge from 20th to 25th June, feed for some days on any remaining green foliage. The author is of the opinion that the locust plantations of the north-eastern part of Jefferson County were infested by the same insect in 1913, since the trees then presented the same appearance. The rapid increase in the numbers of the beetle may have been due to the unusual heat and drought of the summer of 1913 and spring of 1914, but in any case it is probable that locust plantations will suffer severely in future years unless remedial measures are adopted. An arsenical spray applied after the emergence of the adult, between the 20th June and 5th July, might be useful on level ground, but would not be practicable in all localities.

SURFACE (H. A.). **The Seventeen Year Locust.**—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 15, 13th April 1916.

Particulars of expected outbreaks of *Tibicen septemdecim* in the United States are given. The distribution of broods expected in 1919, 1923 and 1928 is discussed in detail.

CHASE (W. W.). **The principal Parasites of the Peach.**—*Georgia Sta. Bd. Entom., Atlanta*, Bull. no. 43, March 1916, pp. 1-39, 2 figs. 14 plates, 4 tables. [Received 2nd May 1916.]

Aegeria (Sanninoidea) exitiosa, Say (peach tree borer) is the most injurious pest of peaches in Georgia. Adults appear in the greatest numbers during the last week in August and in September, though a few may be seen in June and as late as October. The larva feeds on the bark and sapwood until winter, then hibernates. Feeding is resumed in spring, and continues until about August. Pupation takes place in cocoons constructed at or near the base of the tree; the duration of the pupal stage is about four weeks. For the control of the borer, mounds should be formed around the trunk between 10th and 20th August and should be removed early in October to effect the destruction of the larvae. [See this Review, Ser. A, ii, p. 431.] A tarred paper cone which is sealed around the base of the tree is being tested, and so far seems to be more satisfactory than other methods.

Aspidiotus perniciosus, Comst. (San José scale) has five or six generations annually in Georgia. The host frequently dies as the result of attack, but the author believes that death is due rather to the effect of poisons introduced by the insect than to the amount of sap withdrawn in feeding. Two applications of lime-sulphur spray are recommended for the control of this scale.

Conotrachelus nenuphar, Herbst (plum curculio) attacks peach, plum and other fruit trees in Georgia. Hibernation occurs in the adult stage among grass, etc., in and near orchards. Egg-laying continues throughout the summer, the eggs being deposited in a specially prepared cavity in the fruit. The incubation period is about five days, and the larva becomes mature in three weeks. Pupation takes place in the soil at a depth of 3 inches or less. The adult emerges in about three weeks and feeds on leaves and fruit until hibernation. Treatment for this insect should include three sprayings for mid-season varieties, the first, consisting of ¾ lb. lead arsenate and 3 lb. lime to 50 gals. water, applied as soon as the petals have fallen, the second, consisting of self-boiled lime-sulphur and ½ lb. lead arsenate powder, applied three weeks later, and a third similar to the second, given a month before the ripening period. For early varieties two sprays are sufficient, while a fourth spray should be added for late-ripening fruit.

Scolytus rugulosus, Ratz. (shot-hole borer) confines its attacks to unhealthy trees. Hibernation takes place in both larval and pupal stages. Adults emerge in March or later, and deposit eggs in holes in the bark. The egg stage lasts three days, the larval three weeks, and the pupal one week; there are several generations each year. [See this *Review*, Ser. A, ii, p. 432.]

Eulecanium nigrofasciatum, Perg. (terrapin scale) occurs in middle and south Georgia and at intervals causes severe injury. The female hibernates in a state of partial development and reaches maturity in the following spring. The eggs hatch in late April or early May, and the larvae become temporarily fixed to the leaves. Fertilisation takes place from four to eight weeks later, when the partially developed females migrate to the woody parts of the tree. *Eulecanium* (*Lecanium*) *persicae* is occasionally present to an injurious extent in the middle and lower parts of the State. The life-history is similar to that of *E. nigrofasciatum*. Soluble oil preparations, such as Scalecide, applied in spring just before the buds open, at a dilution of 1 to 15, are the most satisfactory materials for destroying these scales.

The fungus and Nematode pests of peaches are also described and the method of manufacturing lime-sulphur concentrates is given.

WOODS (W. C.). **Blueberry Insects in Maine.**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 244, December 1915, pp. 249–288, 3 figs., 4 plates. [Received 2nd May 1916.]

Three species of blueberries occur in Maine, namely *Vaccinium pennsylvanicum*, Lam., *V. canadense*, Kalm, and *V. vacillans*, Kalm. The plants are attacked by several insects. *Rhagoletis pomonella*, Walsh (apple maggot) is restricted to the barrens of Washington County. Adults begin to appear in the middle of July; egg-laying has been observed during August, when the incubation period is two or three days. The average duration of the larval stage in the berry

is 14 days. The fruit usually falls shortly before the larva is mature, but in some cases may remain on the plant until after the larva has entered the soil to pupate. The first puparia were observed on 21st August in 1914. Hibernation takes place in the pupal stage just below the surface of the soil. *R. pomonella* occurs throughout the State as a pest of apple. Individuals bred from apple are larger than those attacking blueberries and efforts to induce them to oviposit in blueberries have always met with negative results. The Braconid, *Biosteres rhagoletis*, Richm., has been reared from puparia of *R. pomonella*. In the field this parasite probably passes the winter within the puparium of the host, and emerges late in the summer. In cases of serious infestation by *R. pomonella*, from 8 to 10 per cent. of the fruit may be injured. The most effective methods of control include the burning over of the plains every three years and the collection of larvae when the berries are winnowed in the field. *Drosophila ampelophila*, Lw., has been reared from berries which have lost their firmness and therefore may prove a serious pest of stored fruit. The weevil, *Pseudanthonomus validus*, Dietz, is widely distributed in Maine, where it attacks *V. pennsylvanicum* and *V. canadense*. It has also been reported as a serious currant pest in Montana. Hibernation of this species occurs in the adult stage. Oviposition takes place in June, the eggs being usually deposited in the calyx lobes. The larva, upon hatching, tunnels to the centre of the berry and feeds there for 30 or 31 days. Pupation occurs in the same position, and the normal duration of this period is about nine days. Adults emerge from the middle of July to the middle of August, feed for some time on the berries, then hibernate. In spring, the overwintering adults feed readily on the leaves. There is probably but one generation annually in Maine; larvae found in August may have developed from eggs deposited late by overwintering forms, or it is possible that they may represent a partial second generation. *P. validus* is parasitised by *Catolaccus* sp., by the fungus, *Sporotrichum globuliferum*, and possibly by several Hymenoptera. A species of *Epinotia* possibly *E. fasciolana*, Clem., has been reared from all three species of *Vaccinium* and appears to be generally distributed throughout the state. Eggs are deposited round the calyx lobes during the latter part of June and early July. The larval stage, which is passed within the berry, occupies about 25 days. When mature, the larvae leave the berries and in the laboratory entered rotten wood in preference to sand or earth. The winter is passed in a cocoon and pupation probably takes place in the spring. This species is parasitised by an Ichneumon, a species of *Pimpla* near *P. indagatrix*, Walsh. The larva of the parasite was found on 11th August, pupated on 14th, and emerged as an adult on 21st August. The eggs of *Nabis rufusculus*, Reut. (blueberry damsel-bug) oviposits on *V. pennsylvanicum* and *V. canadense*, but the nymphs and adults are predaceous on each other, as well as on Psocids and spiders. Eggs have been taken between the middle of June and the middle of July and occasionally in August; the latter may represent a partial second generation.

The most important leaf-feeding pest is the Chrysomelid, *Galerucella decora*, Say, which has caused the death of many bushes in the vicinity of Orono during the past three seasons. The beetle hibernates in the adult stage. Adults are numerous by the middle of June, when

oviposition begins and continues for about a month. The eggs are probably not fastened to the leaves. The duration of the larval stage is from 30 to 35 days. Pupation occurs in the soil about the middle of August or the beginning of September, the duration of the prepupal period being from four to six days, and of the pupal from eight to nine days. Both larvae and adults feed on the leaves, with the result that the whole plant may be entirely defoliated. All stages of this beetle are liable to attack by *Sporotrichum globuliferum*.

MILLER (J. M.). **Oviposition of *Megastigmus spermotrophus* in the Seed of Douglas Fir.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 2, 10th April 1916, pp. 65–68, 3 plates.

Observations on the oviposition of the Chalcidid, *Megastigmus spermotrophus*, Wachtl, in the cones of *Pseudotsuga taxifolia* (Douglas fir) were carried out in Oregon in 1914 and 1915. During 1914, adult males began to emerge from stored seed on 12th April and females on 16th April. The period of maximum emergence occurred between 23rd April and 11th May. The adults fed readily on sugar solution, but though pairing took place frequently, no eggs were deposited in young cones which had been placed in the breeding cage. In 1915, the maximum period of emergence from infested seed was between 20th April and 2nd May in the laboratory, between 1st and 16th May under outdoor conditions, and during the latter part of May and June at elevations of 3,000 or 4,000 feet or more. Adults kept outdoors in a partially shaded position paired between 18th April and 20th May, and the first oviposition in young soft cones was observed on 20th April. Dissection of the cones showed that the ovipositor reached the seed only in a few cases; these alone were successful, since larval development is confined to the seeds. The act of oviposition is described in detail. Egg-laying in the field was only once observed, on 28th May.

MERRILL (J. H.) & FORD (A. L.). **Life-History and Habits of Two New Nematodes Parasitic on Insects.** —*Jl. Agric. Research, Washington, D.C.*, vi, no. 3, 17th April 1916, pp. 115–127, 3 figs.

While investigating the life-history and methods of control of *Saperda tridentata*, Ol., (elm borer) and the termite, *Leucotermes lucifugus*, Rossi, at the Kansas Agricultural Experiment Station, two new Nematodes were found parasitic on these insects. In the case of 121 adults of *S. tridentata*, which were placed in breeding cages, the death-rate due to Nematode parasitisation was apparently 100 per cent. In several colonies of *L. lucifugus* a number of termites were killed and examined and Nematodes were found infesting the head in varying degrees. Of the colonies taken, 76·92 per cent. were thus parasitised. The parasitism of individuals in single colonies ranged from 0 to 100 per cent. Both species have been described as new by Dr. N. A. Cobb, that parasitising *S. tridentata* being *Diplogaster labiata*, and the termite-infesting species, *D. aerivora*. Descriptions of both are given. *D. aerivora* was successfully introduced into termites experimentally.

GOAD (B. R.) & HOWE (R. W.). **Insect Injury to Cotton Seedlings.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 3, 17th April 1916, pp. 129–139, 3 plates.

Damage to the foliage of cotton seedlings probably occurs throughout the entire cotton area in the United States. Though the damage varies much in appearance and intensity, it is characterised by irregular injuries in the cotyledons, varying from small holes or marginal incisions to almost complete loss of the leaf. The later leaves are attacked in the same manner, and in some cases the terminal bud may be lost. The damage is done by Lepidopterous larvae, grasshoppers and leaf-eating beetles. During the spring of 1915 at Tallulah, tussock moth larvae (*Hemerocampa*) were responsible for most of the injury early in the season and were later supplanted by grasshopper nymphs. Plants protected from low temperatures during the night and from bright sunshine in the early morning were equally attacked, but seedlings grown in pots containing baked soil escaped injury. Field examination showed that an average of 8 per cent. of the plants were deformed and that these averaged 2·6 squares per plant less than the normal about the middle of June, involving a loss of over 1,500 squares per acre at the critical period in cotton production in the presence of boll weevils (*Anthonomus grandis*). Some of the Lepidopterous larvae concerned proved to be those of *Estigmene acraea*, Dru., *Prodenia ornithogalli*, Guen., and *Lycophotia* (*Peridroma*) *magaritosa*, Haw.

TAYLOR (E. P.) & WILLIS (M. A.). **Spraying Calendar.**—*Idaho Univ. Agric. Expt. Sta., Depts. Hortic. & Botany, Moscow, Idaho*, Circ. no. 1, 1916.

This circular gives in tabular form a record of the more important insect and fungus pests occurring in Idaho, together with a list of spraying materials suitable for use against them, with the date of application. The requisite formulae and a brief account of the method of manufacture of lime-sulphur, Bordeaux mixture, kerosene emulsion, etc., are given.

EDMUNDSON (W. C.). **Insect Pests of the Orchards and Gardens of Idaho and their Control.**—*Idaho Univ. Agric. Expt. Sta., Dept. Hortic., Moscow, Idaho*, Bull. no. 87, February 1916, 31 pp., 12 figs.

Aspidiotus perniciosus, Comst. (San José scale) occurs in the southern and western parts of the State, attacking many trees and shrubs. *Lepidosaphes ulmi*, L. (oyster-shell scale) is found in every fruit-growing area. The time of hatching of the eggs varies from the end of May to the middle of June. *Chionaspis furfura*, Fitch (scurfy scale) is present, but hitherto has caused little damage. The young scales appear at the end of May or the beginning in June. Both this and the preceding species can be controlled by spraying with Black Leaf 40, lime-sulphur, or miscible oil at the time of hatching. *Aspidiotus ostreaeformis*, Curt. (European fruit scale) attacks the same hosts as *A. perniciosus*, but with less serious results. *Pulvinaria vitis*, L. (cottony maple scale) hibernate in the adult stage. Eggs are deposited

in May or June, and the young upon hatching, settle on the leaves and twigs of the host. A spray consisting of Black Leaf 40 or kerosene emulsion should be applied when the young first appear. *Eulecanium* (*Lecanium*) *corni*, Bch., occurs throughout the State. Lime-sulphur at 5° Bé. should be used against it as a winter spray and Black Leaf 40 or kerosene emulsion at the time of hatching. *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) is one of the most serious pests of apples. The life-history is given in detail. The first spray, consisting of lead arsenate (2 lb. paste or 1 lb. powder to 50 U.S. gals. water) should be applied when from 80 to 90 per cent. of the petals have fallen, the second three weeks later, and a third, if necessary, two or three weeks after the second. The third application will be given about the middle of July in the south and the beginning of August in the north. *Cacoecia* (*Archips*) *argyrospila*, Walk. (fruit-tree leaf-roller) has recently appeared in Idaho, but at present has caused little damage. The eggs, which are laid in June and July, hatch in April or May of the following year. The larvae feed within the webbed leaves for two or three weeks, then pupate; adults emerge after about 10 days. Lead arsenate spray as used for the codling moth is effective, also miscible oil or kerosene emulsion used as a dormant spray. *Eucosma* (*Tmetocera*) *ocellana*, Schiff. (bud-moth) hibernates as an immature larva and adults appear in June and July. Eggs deposited on the leaves hatch in one or two weeks. *Xylina* sp. (green fruit worm) often causes serious damage to orchard trees. *Malacosoma disstria*, Hb., and *M. pluvialis*, Dyar (tent caterpillars), are common on forest trees throughout the State. They may be controlled by lead arsenate spray, using 3 lb. paste to 50 gals. water, or by destruction of the larval nests. *Schizura concinna*, S. and A. (red-humped caterpillar) appears in the adult stage in June and July. The larvae hatching in July and August feed on the terminal leaves of the branches until mature, then pupate under leaves, etc., on the ground. The winter is passed in the pupal stage. *Datana ministra*, Drury (yellow-necked caterpillar) occurs on fruit trees in some areas. *Cacoecia* (*Archips*) *cerasivorana*, Fitch (cherry-tree tortrix) occurs on wild cherry and occasionally in orchards during June and July. *Hyphantria cunea*, Drury (fall web-worm) feeds in autumn within the webbed leaves of the host; adults emerge in June and July. *Orgyia* (*Notolophus*) *antiqua*, L. (vapourer moth) may cause injury in both northern and southern parts of the State. For the control of this species, the removal of egg-masses in winter or early spring and spraying with arsenicals when larvae first appear are recommended. *Eriocampoides limacina* (*Caliroa cerasi*) (pear and cherry slug), can be destroyed by spraying with hellebore at the rate of 1 lb. to 50 gals. water. If lead arsenate is used, it must be applied early, either before or immediately after hatching. *Eriophyes pyri*, Pagst. (pear leaf blister mite), *Bryobia pratensis*, Garm. (brown mite), and *Tetranychus bimaculatus*, Harv. (red spider), can be controlled with lime-sulphur sprays. The most common Aphids present are *Aphis pomi*, *A. sorbi*, *A. pruni*, *Myzus cerasi*, *M. persicae* and *Eriosoma* (*Schizoneura*) *lanigerum*. The most important pests of peaches are *Anarsia lineatella*, Zell., and *Aegeria* (*Sanninoidea*) *exitiosa*, Say. In the former hibernation occurs in the immature larval stage under the bark; there are several generations annually. In the latter species eggs are laid in midsummer on the trunk near the base of the tree;

hibernation takes place in the larval stage in the trunk or roots. Apricot, apple and cherry are also attacked by this species. *Oecanthus niveus*, de Geer (snowy tree cricket) may cause damage to prune orchards in southern Idaho. Arsenical sprays will aid in controlling this species. *Cicada tibicen* often occurs in orchards which are situated near large bodies of timber. *Ceresa bubalus*, F. (buffalo tree-hopper) is common in southern Idaho, and in the north has recently injured young trees. It can be controlled by the destruction of twigs containing eggs and by clean cultivation. *Empoasca mali*, le B. (apple leaf-hopper) is common on young apple trees throughout the State; kerosene emulsion or Black Leaf 40 are effective sprays against this insect.

The most important garden pests are *Leptinotarsa 10-lineata*, Say (Colorado potato beetle), *Epitrix cucumeris*, Harris (potato flea-beetle), *Pieris (Pontia) rapae*, L. (cabbage worm), *Aphis brassicae*, L. (cabbage aphis), *Protoparce (Phlegethontius) sexta*, Joh. (tomato worm), cutworms, *Bruchus pisorum*, L. (pea weevil), *Aphis gossypii*, Glover (melon aphis), *Chloridea (Heliothis) obsoleta*, F. (corn-ear worm), *Thrips tabaci*, Lind. (onion thrips), and *Chortophila (Phorbia) rubivora*, Coq. (raspberry cane maggot).

Formulae for the preparation of the more common spraying materials are given.

HOWE (R. W.). **Studies of the Mexican Cotton Boll Weevil in the Mississippi Valley.**—*U. S. Dept. Agric., Washington, D.C.*, Bull. no. 358, 12th April 1916, 32 pp., 2 figs.

Numerous observations have shown that the complete data secured shortly after 1892 on the biology of *Anthonomus grandis*, Boh. (Mexican cotton-boll weevil) need revision. Under new climatic and other environmental conditions to which the weevil has been subjected in the course of its spread, changes have been taking place in its life-history. A new variety, *A. grandis thurberiae*, Pierce, has also been recorded since that date. Many studies of this pest have therefore been repeated under both the old and new conditions [see this *Review*, Ser. A, ii, pp. 272, 582; iii, p. 545; iv, p. 125].

The information given in the present paper is chiefly presented in a series of twenty-five tables. In northern Louisiana the average longevity of *A. grandis* adults on cotton squares was 54·56 days; on bolls, 31·41 days; on cotton leaves, 8·17; and on okra fruit 5·4. The longevity of the variety *thurberiae* is greater in every instance, the corresponding figures being 61·4, 48·6, 62·04 and 18·3 In *A. grandis* the females exceeded the males on every food except cotton squares, and were also markedly more prolific than those of the var. *thurberiae*, in which the males were longer lived. The average total developmental period of the weevils of both sexes in both squares and bolls was about 14 days. Seven complete generations were developed at Tallulah between the first of June and the first of November 1914.

Hewitt (C. G.). A Review of Applied Entomology in the British Empire.—*Ann. Entom. Soc. America, Columbus, Ohio*, ix, no. 1, March 1916, pp. 1–34. [Received 6th May 1916.]

In an address to the Entomological Society of America, delivered at Columbus, Ohio, in December 1915, the author reviews the outstanding features of entomological work in the British Empire. The formation of the Imperial Bureau of Entomology in 1913 is described and particulars are given of its functions. The agricultural conditions and the more important lines of entomological investigations in the British Dominions and Colonies are also discussed.

McConnell (W. R.). Notes on the Biology of *Paraphelinus speciosissimus*, Girault.—*Ann. Entom. Soc. America, Columbus, Ohio*, ix, no. 1, March 1916, pp. 97–102. [Received 6th May 1916.]

Aphelinine Chalcidoids are important parasites of scale-insects, especially the Diaspinae, as well as of Aphids and Aleurodids. The members of the genus *Paraphelinus* were regarded as exceptions to this rule, until specimens of *P. speciosissimus* were found, during July 1915, emerging from puparia of the Hessian fly (*Mayetiola destructor*). At the present time this parasite has been obtained from six localities in central Pennsylvania, the maximum percentage of parasitism reaching 3·2 per cent. In laboratory experiments from one to ten adults emerged from a single puparium, the average number being about seven. Pairing and oviposition occur soon after emergence. Eggs are deposited in puparia concealed in young wheat plants and in dead stubble, as well as in uncovered puparia. The duration of the adult stage in breeding cages was from three to six days, but was prolonged if oviposition did not occur. Four generations were produced experimentally between 4th July and the end of October. In the field the last generation might not occur. The increase during the entire season would therefore be considerable and this parasite may consequently prove to be an important agent in the control of a serious outbreak of *M. destructor*.

Cogan (E. S.). Homopterous Studies. Part I. Contribution Towards Our Knowledge of the Homoptera of South Africa.—*Ohio Jl. Sci., Columbus*, xvi, no. 5, March 1916, pp. 161–200, 8 plates. [Received 6th May 1916.]

This paper gives an account of the following families :—Cercopidae, Bythoscopidae, Tettigonidae, Jassidae, and Typhlocybidae. As yet none of the Auchenorrhynchous Homoptera in South Africa have proved to be of very great economic importance, but it is possible that this may not always be the case. Reference is made to the depredations of the periodical cicada (*Tibicen septemdecim*), the buffalo tree-hopper, (*Ceresa bubalus*), many frog-hoppers, etc., in the United States. The relation between these Homoptera and other insects as well as higher animals is discussed.

Davis (J. J.). A Nematode Parasite of Root Aphids.—*Psyche, Boston, Mass.*, xxiii, no. 2, April 1916, pp. 39–40, 1 fig.

A species of *Anoecia* on the roots of *Muhlenbergia* at Lafayette, Indiana, was found to be parasitised by an undetermined Nematode. The only other record of a similar case of parasitism is stated to be from Italy, where the root Aphid, *Trama radicis*, Kalt., is also attacked by a Nematode.

Girault (A. A.). New Encyrtidae from North America.—*Psyche, Boston, Mass.*, xxiii, no. 2, April 1916, pp. 41–50.

The following species are described:—*Signiphora flavopalliata occidentalis*, How., from *Chrysomphalus aurantii citrinus*; *S. thoreavini*, sp. n., from *Aspidiotus hederae*; *Neosigniphora elongata*, sp. n., from a Coccid on *Muhlenbergia*; *Aneristus oculatipennis*, sp. n., from *Saissetia oleae*; *Nebaocharis hemipterus*, gen. et sp. n.; *Epanusia albiclava*, sp. n.; *Epidinocarsis subalbicornis*, sp. n., associated with mealy bugs on grape; *Formicencyrtus thoreavini*, sp. n., on *Dactylopius* (*Coccus*) *confusus*; *Zaommoencyrtus submicans*, gen. et sp. n., on *Nyctobates pennsylvanica*; *Ceraptroceroideus cinctipes*, sp. n., from *Aspidiotus helianthi* on *Erigeron canadense*; *Berecyntus bakeri*, Howard, var. *gemma*, var. n., from larvae of *Euxoa* and *Sidemia* (*Hadena*) *devastatrix*; *B. bakeri*, var. *arizonensis*, var. n., from *Chorizagrotis* sp.

Williams (L. T.). A New Species of *Thripoctenus* (Chalcidoidea).—*Psyche, Boston, Mass.*, xxiii, no. 2, April 1916, pp. 54–60, 1 fig.

Thripoctenus nubilipennis, sp. n., a parasite of *Megalothrips spinosus*, Hood, and *Cryptothrips rectangularis*, Hood, occurring in galls on willow twigs, is described. Some notes on the habits of this species and of the allied *T. russelli*, Crawf., are given.

Clausen (C. P.). Mealy Bugs of Citrus Trees.—*California Univ. Agric. Coll., Berkeley*, Bull. no. 258, September 1915, pp. 19–48, 8 figs. [Received 8th May 1916.]

About twenty species of mealy bugs occur in California, but of these only the following attack citrus trees, viz:—*Pseudococcus citri*, Risso, *P. bakeri*, Essig, *P. citrophilus*, Claus., *P. adonidum*, L. (*longispinus*, Targ.), and occasionally *P. ryani*, Ckll., and *Ceroputo arctostaphylii*, Colm.

P. citri is distributed throughout the State. The eggs are deposited in masses on the fruit, twigs, foliage, under loose bark, etc., from 300 to 587 eggs being laid by a single female. The incubation period varies from six to ten days. The number of larvae reaching maturity probably does not exceed 10 per cent. of the total, owing to the heavy mortality occurring in the early stages. The three larval stages of the female occupy 15, 16, and 16 days respectively; egg-laying begins two weeks after the final moult, and death follows as soon as oviposition is completed. In the male the formation of the cocoon occurs about four weeks after hatching and the adult emerges from 10 to 14 days later. The winter is passed mainly in the egg-stage, though other forms may

be present. In San Diego county adults and eggs have been found on the trunk from the surface of the soil to a depth of 6 inches. Spring infestation reaches a maximum from April to June, while autumn infestation begins in September. A list of 43 host plants is given including:—*Gossypium peruvianum* (cotton), *Citrus medica* var. *limon* (lemon), *Solanum tuberosum* (potato), *C. aurantium* (orange), *Cucurbita pepo* (pumpkin), etc. *P. bakeri* is constantly widening its range in California. The list of 29 host plants of this species includes apple, lemon, pear, walnut, etc. The incubation period is eight days in summer. In the female the third moult occurs about 42 days after hatching and oviposition begins several weeks later. In the male the cocoon is formed from one to two weeks after hatching, the adult emerging after nine days.

P. citrophilus has been found in one locality only, near Uplands, San Bernardino county, into which it was probably introduced in 1910. The host plants include *Rheum rhaponticum* (rhubarb), *Grevillea robusta* (silk oak), orange, lemon, walnut, potato, etc. The habit of gathering in clusters, noticeable in *P. citri*, does not occur in this species. The number of eggs deposited by a single female averages 533, while the period of oviposition ranges from 7 to 10 days. In the female the third moult occurs 40 days after hatching; in the male the cocoon is begun about 25 days after hatching and the adult emerges from 9 to 11 days later. The first generation of any size during 1914 hatched in March and reached maturity during the latter part of April. The second generation began to appear about 1st May and reached maturity early in June. Migration of the females was observed at this time. Adults of the third generation appeared in the latter part of July and the first week in August; their numbers were much less than those of the previous brood. Adults of the fourth generation were observed about 1st October, after which date oviposition took place irregularly. All stages were found on citrus during the winter, though adult females were very scarce, and development appeared to be greatly inhibited. Infestation upon the leaves and roots of rhubarb was very heavy during the winter. The distinctness of the generations throughout the greater part of the year should be of value in determining methods of control and the time of application. *P. adonidum*, L. (*longispinus*, Targ.) is a common greenhouse pest. On citrus trees it is confined to the coast counties of California. The host plants include:— *Citrus medica* var. *genuina* (citron), *Ficus carica* (fig), lemon, *Mangifera indica* (mango), *Opuntia* sp. (prickly pear), *Phormium tenax* (New Zealand flax), etc. This species is viviparous and the rate of reproduction is about half that of *P. citri*. Mortality was very great in the first larval period. The average period required by the females to reach the third stage was 44 days; larviposition began from 10 to 15 days later.

Parasitic and predaceous enemies of mealy bugs in California include the Coccinellids, *Scymnus bipunctatus*, Kug., introduced from the Philippines, *Hippodamia convergens*, Guér., and *Novius cardinalis*, Muls.; *Pseudaphycus anglicus*, How, reared from *P. citrophilus*; and the predaceous larvae of *Hemerobius pacificus*, Banks, and *Leucopis bellula*, Will.

Investigations into the control of mealy bugs by means of fumigation with hydrocyanic acid gas show that this method is not to be recommended. *P. citrophilus* was more resistant than all the other species

tested, the larvae being killed only by a 70 per cent. dose. The most efficient means of control is the application of water under high pressure, emphasis being laid on the necessity for thorough application. The pressure should not be less than 175 lb., while considerably higher pressure would be advantageous. The form of stream used should be such as to give a spread of not more than 6 or 8 inches at a distance of 6 feet from the nozzle. From 50 to 100 U.S. gals. are necessary to clean a medium-sized tree. Treatment should be repeated whenever the injury produced by the insect becomes sufficient to warrant the expense. Other spraying materials mentioned are kerosene emulsion, distillate emulsion, kerosene-lime mixture and carbolic acid emulsion. Kerosene-lime mixture, prepared according to the formula, kerosene (42° Bé.) 20 gals., unslaked lime, 40 lb., and water, 200 gals., has been found to be the most satisfactory of all composition sprays tested, and is to be recommended in cases of heavy infestation in which the use of large quantities of water is not possible. The use of lime instead of soap is found to increase the penetrating and adhesive power of the spray, so that a thorough washing or brushing of the fruit must follow each application [see also this *Review*, Ser. A, ii, pp. 434–437, and iii, p. 621].

BIOLETTI (F. T.). **Control of Raisin Insects.**—*California Univ. Agric. Coll., Berkeley*, Circ. no. 134, July 1915, 11 pp., 6 figs. [Received 8th May 1916.]

Stored raisins are liable to attack by various insects, the most common being the Indian meal moth [*Plodia interpunctella*]. This species is abundant in summer and autumn; the eggs are laid on the outside of exposed fruit or in cracks in the packing boxes, and the larvae feed on the outside of the fruit until mature. Pupation takes place within a cocoon, the average duration of the pupal stage being 16 days at 80° F. At 70° F. the duration is more than 32 days. Winter is passed in the pupal or larval stage, according to the temperature. The fig moth [*Ephestia cautella*] is less abundant than the preceding species, but is similar in habits. The saw-toothed grain beetle [*Silvanus surinamensis*] is present throughout the year, though not in large numbers. The rust-red flour beetle [*Tribolium castaneum*] is occasionally found. Infestation of a packing house is due primarily to insects brought in on the raisins from the vineyard or other storing place. Insects removed in cleaning can be prevented from escaping by the use of a moveable frame, having on its under side a cloth pad saturated with coal oil or crude carbolic acid, which can be fitted over the edge of the refuse box. The contents of the box as well as all refuse of stems and injured fruit should be burned, especially between March and September, when breeding is rapid. More perfect control can be obtained by methods aiming at the complete prevention of multiplication in both vineyard and packing house. All raisins should be removed from the vineyard by 1st May; this will prevent breeding during the summer. These methods will prevent infestation in the packing house during the early part of the season. From February to April no raisins should be kept in the house for more than four days, and then only in quantities sufficient for current needs. Fumigation

with carbon bisulphide may be carried out before packing. About 10 lb. carbon bisulphide should be allowed to 1,000 cubic feet. The fumigant is placed in shallow dishes on top of the raisins and allowed to remain for 24 hours.

GRAY (G. P.). **Standard Insecticides and Fungicides** *versus* **Secret Preparations.**—*California Univ. Agric. Coll., Berkeley*, Circ. no. 141, October 1915, 4 pp. [Received 8th May 1916.]

In this circular an account is given of certain proprietary compounds which, by analysis, have been shown to be useless as insecticides and fungicides, and in certain cases to have an injurious effect on the plant to which they are applied. An insecticide or fungicide of secret composition sold under a trade name lays itself open to suspicion for the following reasons :—(1) Under existing insecticide laws, it is possible to prepare any mixture which is not absolutely injurious and to impose it on the public. (2) No standard can be made for proprietary preparations. (3) Copyrighted names are often used to obtain a high price for the material. Consumers are urged to use standard preparations and to avail themselves of information which has been based on experiments carried out under the direction of the United States Department of Agriculture and the Agricultural Experiment Stations.

PARROTT (P. J.). **Injurious Insects, Old and New.**—*Proc. 61st Ann. Meeting, Western New York Hortic. Soc., Rochester*, 1916, 10 pp., 2 plates. [Reprint received 12th May 1916.]

During 1915 various species of grasshoppers, including *Melanoplus atlantis*, *M. femur-rubrum* and *M. femoratus*, and the orchard tent caterpillar [*Malacosoma americana*] were abundant and destructive in many sections of the State. The carrot rust fly [*Psila rosae*] caused serious injury to celery and carrots in various districts. The onion thrips [*Thrips tabaci*], cherry maggot [*Rhagoletis cingulata*], and the apple maggot [*R. pomonella*] appeared in destructive numbers. *Galerucella cavicollis* (cherry flea-beetle) occurred in cherry and peach orchards throughout Western New York; this species normally feeds on the wild cherry, *Prunus* sp. Observations on the rosy aphis of apple [*Aphis sorbi*] showed that the nymphs apparently emerged from the eggs by the time the tips of the leaves were projecting from the buds. By 23rd May many leaves had become curled by the stem-mothers. A period of rapid multiplication began on 23rd May; between 8th and 18th June the stunting and deforming effects on the young fruit was observed. Late spraying, carried out when the Aphids were present in destructive numbers, was shown to be of little use, since the insects were able to shelter in large numbers within the curled leaves. Spraying at the time of the opening of the buds proved satisfactory, but to prevent reinfestation, applications of nicotine solution and soap were required at intervals of one month. Contact insecticides, such as soap, oil emulsion, or nicotine solution were found to lose their toxicity as soon as the spray dried on the foliage. A mixture of lime and nicotine produced a remarkable freedom from Aphids and other insects throughout the summer.

Two important pests were found in fruit-growing sections, namely, *Agrilus sinuatus* (sinuate pear borer) and *Zeuzera pyrina* (leopard moth). *Tetranychus mytilaspidis* (citrus mite) was observed on apples and pears in Ontario county. This species is a pest of citrus trees in Florida and California, causing the premature falling of the leaves, but can be controlled by the use of a lime-sulphur spray or dry powdered sulphur. *Galerucella cavicollis*, feeding normally on *Prunus pennsylvanicus*, was observed to migrate to cultivated fruits during early June; young plantings of sour cherries and peaches were most severely attacked. Arsenate of lead or arsenate of lime (8 lb. to 100 U.S. gals. water) sprayed on both sides of the leaves, or arsenicals combined with Bordeaux mixture, gave satisfactory results. Nicotine solution and soap proved most suitable for peach trees.

PARROTT (P. J.) & GLASGOW (H.). **Sinuate Pear Borer and Leopard Moth.**—*New York Agric. Expt. Sta.*,. *Geneva*, Circ. no. 44, 1st December 1915, 3 pp., 2 plates. [Received 12th May 1916.]

Agrilus sinuatus (sinuate pear borer) and *Zeuzera pyrina* (leopard moth) have been found in fruit-growing sections of New York State on imported nursery stock. *A. sinuatus* is confined to the south-eastern portion of the State, being restricted to five or six counties contiguous with the Hudson River. The adult appears early in June and deposits eggs in crevices in the bark of the trunk or branches of the pear. Upon hatching, the larva burrows a winding tunnel in the sapwood. The presence of the borer is shown externally by a splitting or swelling of the bark. As a result of attack, the tree is either killed or rendered unproductive. The adults feed readily on the foliage and so may possibly be controlled by the application of an arsenical spray during the latter part of May. For small trees the most effective method of control is to cut into the mine and destroy the larvae. The use of a wash on the trunk and branches, to serve as a deterrent to oviposition, is worthy of trial.

Z. pyrina is present in the same area as the preceding insect. It has been observed on various kinds of nursery stock and on old pear trees. In Europe shade trees, apple, pear, cherry and plum are attacked. The eggs are deposited in crevices of the bark. The larvae burrow in the middle of young twigs in the early stages, and later attack larger branches, in which they mine beneath the bark. The bark covering infested areas usually decays, and in cases of severe attack the death of the tree may result. Control measures include the destruction of infested branches and twigs, together with that of larvae in the mines by probing or fumigation with carbon bisulphide.

PARROTT (P. J.), HODGKISS (H. E.) & LATHROP (F. H.). **Plant Lice Injurious to Apple Orchards. I. Studies on Control of Newly-Hatched Aphides.**—*New York Agric. Expt. Sta.*, *Geneva*, Bull. no. 415, February 1916, pp. 11-53, 6 figs., 8 plates, 9 tables. [Received 12th May 1916.]

This bulletin contains further data on the habits of Aphids, on the susceptibility of newly-hatched forms to various insecticides and on

the effects of spraying when the buds are opening in reducing injuries to the apple crop. In western New York, the hatching of *Aphis sorbi*, Kalt. (rosy apple aphis) occurred during the period of the swelling and breaking of the buds; all the nymphs probably emerged by 24th April. Stem-mothers were observed to be reproducing on 3rd May, and were occupying exposed positions on the stems of the flower-buds or on the underside of the leaves. For a period about 7th May, a decrease in the numbers of stem-mothers, probably due to enemies, was noted. On 12th May a noticeable increase occurred, coincident with the maturing of the individuals of the second generation. Solitary stem-mothers or stem-mothers with from 8 to 52 offspring were observed as late as 23rd May at Geneva and 29th May at Wolcott. A few days of high temperature and marked humidity in the middle of June resulted in a rapid multiplication on the part of the insects, and caused the complete infestation of new leaf-clusters and the tips of young shoots. The stunting and deforming effects on young apples was very evident in the Station orchards by 18th June. Winged forms were first observed at Geneva on 8th June and at Wolcott on 12th June and in the following week were found on *Plantago lanceolata*, L. Large numbers of both winged and wingless forms were present on apple on 22nd June.

Aphis avenae, F. (oat aphis) began to hatch at Geneva on 16th April, and continued until the leaves were showing green. Maturity was reached by some specimens on 26th April and by 3rd May the blossom clusters were heavily infested. Sap was found to be oozing from the feeding punctures and in some instances the surfaces of the stems were roughened. The leaves were beginning to curl at this date. Winged forms were first detected on 12th May, were abundant on apple by 20th May and by 29th May had practically all migrated to the summer host.

A. pomi, de G. (green apple aphis) hatched between 16th and 24th April. Stem-mothers began to mature on 4th May, when the blossoms were showing pink. Winged forms appeared on 15th May. At Geneva this species was present in great numbers on the terminal growth of nursery stock and of young trees. The insects showed a tendency to ascend the growing shoots and attack the unfolding buds; consequently during early summer the damage to the foliage was not very marked, since the insects were not established on the individual leaves for a prolonged period. During August, the terminal leaves appeared less able to resist attack and frequently became curled, blackened with fungus, or even killed. On 22nd June and on the succeeding days a flight of winged forms was observed, coming from an unknown source and settling on the under surfaces of the new leaves of trees in Geneva.

These three species feed on the succulent tissues, such as stems of the unopened flowers, stems of young fruit, and leaves. Dwarfing of the apples is mainly due to *A. sorbi*; the effect of *A. pomi* and *A. avenae* on the setting of the crop and the development of the fruit is uncertain. The injuries caused by the three species are cumulative, the damage caused by one species being intensified by the succeeding species. The rate of growth of young apples appeared to be in inverse proportion to the degree of infestation. Malformations were not marked when infestation was restricted to the foliage of a fruit cluster.

In the spraying experiments lime-sulphur, testing 32° Bé., was used in the proportion of 1 gal. to 8 gals. water and to every 100 gals. of dilute mixture was added ¾ pt. nicotine solution. The spray was applied to three plots on 24th, 26th, and 27th April respectively, applications being made at high pressure. Ten gallons were used for each tree. The results showed that newly-hatched Aphids were readily destroyed, especially in the case of *A. avenae*, and thus a considerable degree of protection was afforded to the fruit and foliage. A slight scorching of the leaves followed the application of lime-sulphur and nicotine and crude carbolic acid emulsion sprays, but this was soon obscured by growth. Soap and nicotine solution, in the proportion of 5 lb. soap, ¾ pt. nicotine solution (40 per cent.) and 100 U.S. gals. water, was the only combination that did not injure the foliage at all. Sodium sulphide and soap caused serious damage to both flowers and leaves.

Spraying against *A. pomi* was performed first on 20th April when the buds were well infested. An application of lime-sulphur and nicotine on this date kept the trees free from insects until 22nd June. Spraying was repeated on 22nd June, 10th July and 2nd August, on account of reinfestation by winged forms. As a result there was little evidence of discoloration and curling of the leaves, and the growth of the trees appeared to be normal. Nicotine and soap were found to possess a higher rate of toxicity and spreading and wetting properties superior to that of other preparations. A mixture of lime and nicotine used in the later sprayings was found to retain its toxicity longer than other insecticides and acted as a repellent against the pear psylla [*Psylla pyri*], leaf-hoppers and Aphids. Auxiliary tests carried out in Niagara and Orleans counties proved the advantages to be derived from spraying while the buds were expanding. Spraying at the end of May or early in June may have the effect of injuring fruit and leaf-clusters while the Aphids are then protected by the curled leaves.

WHITNEY (L. A.). **The Yellow Currant and Gooseberry Fruit-Fly (*Epochra canadensis*, Loew).**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 4, April 1916, pp. 152–157, 5 figs.

Epochra canadensis is generally distributed throughout the currant and gooseberry growing districts of the United States and Canada; in California it is apparently confined to the central and northern parts of the State. The eggs are deposited in the fruit, beyond the reach of arsenicals and poisons. The larval stage is passed within the berry. When the larva is mature, the fruit usually drops to the ground, and the larva enters the soil to a depth of one inch to pupate. There is one generation annually. The puparium may be found during autumn and winter in the soil near infested plants. Under laboratory conditions adults emerged from 23rd February to 11th March. The only possible method of control would be one similar to that used against apple and cherry fruit-flies, *i.e.*, the use of a sweet, poisoned spray against the adults before oviposition.

MASKEW (F.). Quarantine Division; Report for the Month of February, 1916.—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 4, April 1916, pp. 158–160.

The following pests were intercepted during February 1916:—From China: *Chionaspis citri*, *Chrysomphalus* sp., *Pseudaonidia trilobitiformis*, *Lepidosaphes gloveri*, *Parlatoria pergandii*, and *P. ziziphus* on pomelos. From Florida: *Phomopsis citri*, *Lepidosaphes beckii*, *Parlatoria* sp. and *Chrysomphalus* sp. on grapefruit. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapple; *Coccus longulus* on betel leaves; *Hemichionaspis minor* and *Chrysomphalus aonidum* on coconuts; *Pseudococcus* sp., *Parlatoria* sp., and *Lepidosaphes* sp. on croton cuttings; *Pseudaonidia* sp. on Hibiscus cuttings. From Holland: *Lepidosaphes ulmi* on boxwood. From Japan: Eggs of *Cicada* sp. on persimmon; *Phomopsis citri* on orange; *Pseudococcus* sp. on wistaria; *Antonina crawi* and *Leucaspis bambusae* on bamboo; *Aleurodes* sp. on gardenia; weevil larvae in chestnuts; *Pseudococcus* sp. and Lepidopterous larvae on azaleas and taomaba. From Mexico: *Lepidosaphes gloveri* on limes; weevil larvae in tamarinds; *Chrysomphalus aonidum* and *C. aurantii* on rose cuttings; *Chrysomphalus* sp. on coconut; *Parlatoria pergandii* and *Parlatoria* sp. on ornamental tree cuttings; *Lepidosaphes* sp. on lemons. From Tahiti: *Pseudococcus nipae* on coconut palms. From Central America: *Aspidiotus cyanophylli* and *Pseudococcus* sp. on banana. From Colorado: *Phomopsis citri* and *Lepidosaphes beckii* on grapefruit. From Cuba: *Pseudococcus* sp. on tomato. From Illinois: *Aleurodes citri* and *Chrysomphalus aonidum* on citrus. From New York: *Aspidiotus perniciosus* on a lilac bush. From Ohio: *Aleurodes citri* on Cape jasmine, and *Aleurodes* spp. on ornamental plants. From Texas: *Parlatoria pergandii* on grapefruit. From Utah: *Phomopsis citri* and *Lepidosaphes beckii* on grapefruit. From Washington, D.C.: *Phomopsis citri*, *Lepidosaphes beckii* and *Leptothyrium pomi* on grapefruit. From Chile: unidentified larvae in potato. From France: *Monarthropalpus buxi* on boxwood.

EHRHORN (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agric., Honolulu*, xiii, no. 4, April 1916, pp. 104–106.

The following pests were intercepted during January 1916:—From Manila: Psocids on algaroba seeds. From Japan: *Parlatoria pergandii* (chaff scale) on camellia; scale-insects on pear. From San Francisco: Chrysomelids and *Gastroidea cyanea* in the soil around the roots of plants.

Over 10,000 fruit-fly parasites were bred and liberated. A parasite of the citrus mealy bug [*Pseudococcus citri*] was introduced from California; this species has been observed to attack the large sugar-cane mealy bug [*P. sacchari*] and the pineapple mealy bug [*P. bromeliae*]. The number liberated during January was small on account of the unfavourable weather conditions.

JARVIS (E.). **Combating the Cane Beetle.**—*Queensland Agric. Jl., Brisbane*, v, no. 4, April 1916, p. 225.

Field investigations in connection with the oviposition of *Lepidiota albohirta* led to the discovery, during January, of a single egg-mass

containing 13 eggs, deposited in the soil at a depth of 5 inches. Breeding experiments showed that the number of eggs laid varied from 10 to 26 in different individuals. It is probable that under natural conditions the majority of the eggs mature simultaneously and are laid in a mass of about 24, while the few which remain in the ovarian tubes develop later and are deposited singly or in groups of two or three.

Jarvis (E.). **A New Light-Trap for Cane Beetles.**—*Queensland Agric. Jl., Brisbane*, v, no. 4, April 1916. pp. 226–230, 2 figs.

The trap described in this paper consists of a wooden framework with a flat bottom of wood or galvanised iron, and fitted with landing platforms of galvanised iron inclined at an angle of 30°. The acetylene lamp placed in the middle of the trap is protected at the sides by sheets of glass and above by close-mesh wire gauze and an iron roof. Beetles falling through the aperture between two landing stages into the body of the trap are prevented from escaping by the presence of a narrow strip of metal placed just below the base of the aperture. Parasites and predaceous enemies escape through small openings at the base of the trap. On the one occasion on which the trap was used it was placed at a height of 3 feet above the ground; 66 beetles were caught between 8 p.m. and 9.15 p.m. The only satisfactory time for using light traps is during the period between emergence and oviposition, the length of this period being determined by climatic conditions.

Gough (L.). **The Life-History of *Gelechia gossypiella* from the Time of the Cotton Harvest to the Time of Cotton Sowing.** — *Ministry Agric., Egypt, Tech. Sci. Service, Cairo*, Entom. Sect., Bull. no. 4, 29th March 1916, 16 pp., 3 tables. [Received 15th May 1916.]

Gelechia gossypiella, Saund., has several generations in Egypt during the summer months, each lasting a few weeks. In autumn, the larvae hibernate and pupate in the following spring. The first picking of cotton seed is usually only injured to a slight extent, while the second and third pickings are more seriously damaged. Examination of seed from the first picking showed the presence of a certain number of hibernating larvae, while in seed from the second picking, the number was much greater. Further observations showed that larvae maturing after the first picking hibernate before pupation, the hibernation period normally lasting until the next spring or summer, but sometimes extending over two years. Larvae maturing before, or at the time of the first picking mostly pupate and emerge as moths during the next few months, but before the next crop season. During the winter a hibernating and a winter-feeding brood are present; these re-establish the pest during the next season. Moths emerging in autumn and winter are not important in maintaining the species and would be still less so if the destruction of bolls on stored cotton sticks were systematically carried out. Hibernating larvae occur in seed cotton and in cotton seed, in bolls left on cotton sticks and in bolls left in the fields. The larvae are able to withstand burial under growing crops and certain limits of moisture or dryness without losing their vitality. Efficient control is only possible if the destruction of all bolls is undertaken at

the time of the last picking. Cotton seed (other than that for sowing) and seed cotton stored after the middle of January should be kept in moth-proof stores, and cotton seed intended for sowing should be fumigated or treated by heat before distribution. All other seed should be crushed or exported before 1st April, unless treated in a similar way.

JACK (R. W.). **Rhodesian Citrus Pests.**—*Rhodesia Agric. Jl., Salisbury*, xiii, no. 2, April 1916, pp. 215–233, 6 plates.

Aphis tavaresi (black orange aphis) is generally distributed throughout South Africa and attacks young citrus trees especially during the spring months before the rains. Reproduction during the warm season is mainly parthenogenetic. Both winged and wingless females occur and the young produced are capable of parthenogenetic reproduction within a few days. The natural enemies include several Coccinellids, of which *Chilomenes lunata* is the commonest, Syrphid larvae, lacewing flies and Hymenopterous parasites. Climatic conditions probably form the most effective natural check on these insects. The best artificial method of control is the use of a contact insecticide, such as dilute paraffin emulsion, resin wash, nicotine solution, etc. A species of *Trioza* occurs in several widely separated localities in Southern Rhodesia. It attacks the young foliage of all varieties of citrus, causing a characteristic wrinkled appearance. An internal parasite has been detected in insects obtained in Umtali, and in Cape Colony a Syrphid enemy has been recorded. Remedial measures include hand-picking or spraying with washes used against scale-insects. In addition to *C. lunata*, Aphids and scale-insects in Rhodesia are attacked by the following Coccinellids :—*Novius cardinalis*, *Aulis foedata*, *Chilocorus distigma*, *Exochomus auritus*, *Lotis neglecta* and *Alesia bohemani*. *Papilio demodocus* (citrus butterfly) sometimes causes defoliation of young trees, but as a rule is not a serious pest. The larvae can be controlled by hand-picking, while the adults, which are attracted to beds of bright flowers, can be captured in such situations. *Argyroploce leucotreta* (citrus codling moth) is sometimes abundant in neglected orchards, where as much as 70 per cent. of the fruit may be rendered useless. The eggs are laid singly on the fruit. The larva, upon hatching, bores into the pulp, emerging only to pupate in the soil. The duration of the developmental periods in acorns in South Africa is as follows :—Egg-stage, from 9 to 10 days; larval stage, from 84 to 90 days; pupal stage, from 14 to 18 days; there are probably three generations during the year. On citrus fruits the larval stage is probably shorter. There are no definite broods in Rhodesia, adults having been bred during every month, except December. Infested fruit ripens prematurely and falls from the tree. Injury also allows the entrance of moulds and bacteria which hasten decay. This species has been bred from orange, naartje, lemon, guava and pomegranate and also from the wild fruits of *Zizyphus mucronatus* and *Sclerocarya caffra*. In South Africa additional hosts are acorns, apricots, peaches, plums and the wild plum. Repressive measures include the destruction of infested fruit, the elimination of alternative hosts and the discontinuance of the production of citrus fruits out of season. Three species of fruit-piercing moths, namely, *Othreis materna*,

O. fullonica and *O. divitiosa* are known in Rhodesia, as well as in India, Australia, and the Malay Archipelago. The adults are able to pierce the rind of various citrus fruits in order to feed on the juices within. The moths were abundant in January and February 1915, but injury decreased rapidly after March. The puncture becomes surrounded by a decayed area and the fruit falls early. Certain varieties of orange, especially Washington Navel, are more liable to attack than others. Peach, plum, apple, banana, mango, grape and quince are also injured. The method of protecting the trees by mosquito netting cannot be applied in large orchards. In Queensland, bananas of the Cavendish type planted among citrus trees prove attractive to the moths; this variety will not grow in Rhodesia, but could be imported and the ripe fruit hung among the trees. Adults visiting it could be collected or destroyed by impregnating the bait with an arsenic compound. The foliage of citrus trees is occasionally injured by the weevils, *Systates* sp. and *Rhinosomphus (Periscopelta) mutabilis*. Spraying with lead arsenate at the rate of 3 lb. to 50 gals. water should prove an efficient remedy. Two species of Coreid bugs have been recorded as attacking the fruit of orange and green granadillas respectively, but cannot at the present time be regarded as pests. Other occasional feeders on citrus are *Chrysomphalus hederae* (oleander scale), on the over-ripe and green fruit and foliage of lemon; a soft scale, distinct from *Coccus hesperidum*, on orange; a species of mealy bug; cicadas; the Pentatomids, *Agonoscelis puberula* and *A. erosa*; two species of Tortricid moths; a boring Cerambycid beetle, and the fruit-flies, *Ceratitis capitata* and *Ceratitis* sp.

VAN ZWALENBURG (R. H.). **Notes on the Life-History of *Ecpantheria eridanus*, Cramer.**—*Insecutor Inscitiae Menstruus, Washington, D.C.*, iv, nos. 1–3, January–March 1916, pp. 12–17. [Received 16th May 1916.]

The Arctiid moth, *Ecpantheria eridanus*, is common in the island of Porto Rico and has a wide range of host plants. These include *Erythrina micropteryx*, orange, *Ipomoea* sp., vanilla, banana, *Cissus* ? *sicyoides* and *Panicum* sp. At the experiment station the larvae caused some damage by feeding on the flower buds of vanilla. Eggs are laid both by fertilised and unfertilised females, oviposition beginning one or two days after emergence. The eggs are deposited in masses on the upper leaf-surface, in the case of the orange. The incubation period varies from six to eight days, and the larval period from 24 to 62 days. Pupation takes place within a cluster of leaves or in a rolled leaf, and occupies from 15 to 20 days. The larvae are attacked by the Ichneumon, *Eremotylus angulatus*, Hook., and by a fungus, probably an *Empusa*.

TOWNSEND (C. H. T.). **Description of Two New Tachinids (Dip.).**—*Entom. News, Philadelphia*, xxvii, no. 5, May 1916, p. 217.

The new species described are *Doryphorophaga aberrans*, reared from *Leptinotarsa decemlineata*, Say, and from *Blepharida rhois*, Forst., and *Euphorocera floridensis*, reared from *Anticarsia gemmatalis*.

Girault (A. A.). Descriptiones Hymenopterorum Chalcidoidicorum variorum cum Observationibus. iii.—*Entom. News, Philadelphia*, xxvii, no. 5, May 1916, pp. 223-228.

The following species are described:—*Eupelmus inyoensis*, sp. n., from California; *E. coccidis*, Gir.; *Pseudomphale ancylae*, sp. n., reared from *Ancylus nubeculana* in Virginia; *P. steirastomae*, sp. n., reared from the larvae of *Steirastoma depressum* in Trinidad; *P. gracili-ventris*, sp. n., reared from an egg-mass of a Cassidid in Trinidad; *Psilophrys pulchripennis*, Ashm.; *Habrolepopteryx pulchripennis*, Ash., var. *aeneiscapus*, var. n.; *Paracalocerinus americanus*, sp. n., from Kansas; *Aphidencyrtus (Eupelmus) schizoneurae*, Ashm.; *Holencyrtus physokermis*, sp. n., reared from *Physokermes picea* in Wisconsin; *Encyrtus ensifer*, How.; *Xenocrepis mexicana*, sp. n., parasitic on a Coccinellid larva which preys on *Saissetia (Lecanium) oleae* on orange in Mexico, and reared from the larva of *Azya orbigera* in Mexico; and *Polynema piceipes*, Gir.

Kwiat (A.). Collecting Papaipemae (Lep.)—*Entom. News, Philadelphia*, xxvii, no. 5, May 1916, pp. 228-234.

The larvae of the Noctuid genus *Papaipema* are borers in the stems or roots of annual or perennial plants and in at least one instance in the young shoots of an indigenous tree. Adults appear between 15th August and 5th October. Eggs are deposited on or near the food-plant and hatch in the following spring. The larvae cause the leaves to wilt or become yellow and hinder the general growth of the plant. Pupation takes place in the burrow or in the soil and the pupal period lasts four or five weeks. A list of species is given with the food-plants and brief notes on the life-history. The majority attack weeds, some are found on ferns and garden plants, while *P. furcata*, Smith, occurs in young shoots of ash, *P. humuli*, Bird, in stem of hops, and *P. necopina*, Grote, in the base of the stalk of *Helianthus tuberosa* and *H. rigidus*.

Parker (H. L.). *Tribolium confusum*, Duval, as a Museum Pest (Col.) *Entom. News, Philadelphia*, xxvii, no. 5, May 1916, p. 234.

Considerable damage has been caused to collections of insects at Hagerstown, Md., by *Tribolium confusum* (small flour beetle). The beetles, which bred in large numbers in a sack of bran, migrated to the laboratory, where many insects in the collections were destroyed.

Howard (L. O.) & Chittenden (F. H.). The Catalpa Sphinx.—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 705, 16th February 1916, 9 pp., 5 figs. [Received 17th May 1916.]

The most important insect pest of catalpa in the United States is *Ceratomia catalpae*, Boisd. (catalpa sphinx), which is common in Virginia, Maryland and Ohio and appears to be spreading northward to Pennsylvania, New Jersey and Delaware. Inland, the insect has been recorded as far west as Texas. The eggs are laid in masses on the underside of the leaves or on the stems and branches.

In the neighbourhood of Washington, D.C., there are two generations annually; in the south, three or four broods occur each year, the last generation wintering in the ground in the pupal stage, while moths emerge in the following March. In Florida the complete life-cycle is passed through in about six weeks. *C. catalpae* is attacked by several parasites, such as *Apanteles congregatus*, Say, which is common in the eastern States, but is itself attacked by *Mesochorus aprilinus*, Ashm., and *Hemiteles mesochoridis*, Riley. *Microplitis* (*Apanteles*) *catalpae*, Riley, another parasite of *C. catalpae*, is parasitised by *Hypopteromalus tabacum*, Fitch, and *Horismenus* (*Holcopelte*) *microgastri*, Ashm. The larva of *C. catalpae*, is also attacked by the Tachinids, *Phorocera claripennis*, Macq., and *Frontina frenchii*, Will. Cuckoos, the catbird and the Baltimore oriole are predaceous on the larva. The methods for controlling *C. catalpae* include handpicking, spraying with arsenicals and the destruction of pupae. The arsenicals generally used are lead arsenate and Paris green, allowing 3 lb. of the former or 1 lb. of the latter to 50 gals. water. The arsenicals may with advantage be applied in combination with Bordeaux mixture for the control of leaf spot disease. In the autumn following a severe attack, the soil around the base of the trees should be thoroughly dug up in order to destroy the pupae. Larvae of the last generation are usually heavily parasitised; they should therefore be collected and placed in boxes covered with wire netting through which the parasites can escape.

HOWARD (L. O.) & CHITTENDEN (F. H.). **The Leopard Moth: a dangerous imported Insect Enemy of Shade Trees.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 708, 14th February 1916, 12 pp., 4 figs. [Received 17th May 1916.]

Zeuzera pyrina, F. (leopard moth) occurs in the Old World in central and southern Europe, southern Sweden, south-western Africa, Algeria, northern Morocco and the western part of Asia Minor. It has been introduced in the United States within recent years and is at present distributed along the Atlantic coast from eastern Massachusetts to southern New Jersey and in the Hudson River Valley. The larvae cause injury to shade trees and ornamental plants and sometimes to orchards by boring in the wood, thus weakening and sometimes killing the trees. In America adults emerge from May until late in September. The power of flight possessed by the female is very limited. Eggs are deposited in groups of three or four in crevices of the bark; about 800 may be laid by a single female. The larvae, which hatch in about 10 days, bore into the pith of twigs or into the heartwood of larger branches. Maturity is reached two years after hatching. Pupation begins during May and this stage is passed within the burrow. The presence of the borer is indicated by an accumulation of excrement and frass at the entrance of the burrow.

In Europe the following Hymenopterous parasites have been reared from *Z. pyrina*:—*Schreineria zeuzerae*, Ashm., *Microgaster* sp., a Proctotrupid, and an indeterminate Chalcidid, perhaps *Litomastix* (*Copidosoma*) *truncatellum*, Dalm. In America no parasites are known, but predaceous enemies include woodpeckers, sparrows, bats and squirrels. The most suitable method of control is the injection of carbon bisulphide into the burrows; the aperture should be afterwards closed with wax. The adults are attracted to a certain extent by lights and this method can therefore be used in addition.

SIMANTON (F. L.). *Hyperaspis binotata*, a **Predatory Enemy of the Terrapin Scale.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 5, 1st May 1916, pp. 197–203, 1 fig., 2 plates, 3 tables.

The Coccinellid, *Hyperaspis binotata*, Say, is one of the most important enemies of Lecanium scales, especially of *Eulecanium nigrofasciatum*, Perg. (terrapin scale). This beetle occurs in most of the territory east of the Mississippi and extends west of that river to the semi-arid region. In the Atlantic States it is most abundant from Connecticut to Maryland, and is common from New Jersey to Illinois. The food consists of honeydew, Aphids and their eggs, mealy bugs and soft-bodied scales. The larvae apparently feed on scale larvae and young scales. Adults emerge from hibernation about the middle of April and begin mating about 20th of that month. When feeding on the terrapin scale, the hibernating place is usually at the base of scale-infested peach trees. After emergence, the beetles leave the peach tree until the adult scale begins to secrete honeydew, i.e., about the middle of May. They then return and feed on the scale and its honeydew until about the middle of July, by which time most of the over-wintering beetles are dead, and the new brood have emerged. There is some indication that a second brood may occur. The eggs are deposited in crevices of the bark near the host. In 1913 the first eggs were observed on 3rd May, but these and later eggs were eaten by the beetles. Eggs laid on 26th May were allowed to hatch. Oviposition reached a maximum on 5th June, and continued until 1st September. The incubation period varies from six to eight days, the average for 18 eggs deposited between 27th and 30th June being seven days. The larvae, upon hatching, enter the brood chamber of the scale, where they remain during the first two instars and feed on the larval scales. In the third and fourth instars many mature scales are destroyed. The beetle larva then migrates to the leaves where it continues to feed on such larvae as have been able to reach the leaves. The total length of the larval period varies from 17 to 23 days. It is estimated that one Coccinellid larva will destroy 90 mature scales and 3,000 larvae. Pupae appear in the field from 7th to 20th July and occasional specimens as late as October; they are found attached to leaves or concealed in clusters under the bark. The natural enemies include aphis lions, preying on the eggs, and *Brachymena* [?] sp., attacking the adult.

The Mexican Cotton Boll Weevil.—*Georgia State Bd. Entom., Atlanta*, Bull. no. 44, March 1916, 22 pp., 4 figs. 7 plates. [Received 23rd May 1916.]

Anthonomus grandis, Boh. (Mexican cotton-boll weevil), was first recorded in Georgia on 25th August 1915, when a specimen was taken at Thomasville. By 16th November 1915, records were made in about 40 counties, in most of which the insect was abundant. The introduction into Georgia was due to the high winds which occurred for a few days before its first appearance. The area of new territory covered by the weevil in 1915 was estimated at 86,000 square miles. A considerable advance was also noted in North-west Texas.

The annual loss from the weevil in other cotton-growing states is discussed [see this *Review*, Ser. A, ii, p. 649]. *A. grandis* is able to

maintain itself on native Malvaceous and other plants and this fact should be taken into account when considering methods of control. [See this *Review*, Ser. A, ii, p. 582, and iv, p. 125.] An account of the life-history, natural enemies and artificial methods of control is given. [See this *Review*, Ser. A, iii, p. 424.] Spanish moss is stated to be a favourable hibernating medium since it is not readily penetrated by low temperatures. A list is given of 53 species of birds which are predaceous on this weevil.

SANDERS (J. G.) & FRACKER (S. B.). *Lachnosterna* **Records in Wisconsin.**—*Jl. Econ. Entom., Concord*, ix, no, 2, April 1916, pp. 253-261, 3 figs.

In the experiments carried out in Wisconsin in 1914–15 in connection with *Lachnosterna*, the factors considered were :—(1) the determination of conditions ; (2) the crops most seriously damaged with and without rotation ; (3) the species present and the habits, life-history, distribution and means of control. Lantern traps were used to collect the beetles. They consisted of the Coleman gasoline arc lantern, from 300 to 400 candle power, set into galvanised refrigerator pans, 5 inches deep and 24 inches in diameter. The pans were filled about two-thirds full of water and ½ pt. kerosene was poured on this and renewed when necessary. Perforated skimmers were used to remove captured insects. Results were obtained relating to the distribution of species over a comparatively limited area, the optimum temperature for flights and the most favourable location and arrangement of light traps. Seventeen out of the 19 species known to occur in Wisconsin were taken in the traps. *L. fusca* was most widely distributed and dominant at Lancaster and Dodgeville. *L. rugosa* was dominant at the north-east stations and *L. implicita* at Ripon. Males only of *L. gibbosa* and *L. nitida* were attracted to the lantern and *L. tristis* only to a slight degree. Several species disappeared at the stations furthest to the north-east, while *L. rugosa*, *L. dubia* and *L. grandis* increased in numbers. *L. dubia* emerged very early, before 21st May at Dodgeville and to the extent of 92 per cent. before this date at Baraboo. Flight was found to cease almost entirely at 62° F. Large pans were found to be desirable ; the number of beetles caught in a pan placed by the side of the central pan towards the origin of flight was twice as great as in a pan placed behind the light. At the Lancaster station flight was always from the north-west towards the south-east. Traps near the margin of woods or close to a fringe of trees were most successful. At Lancaster, more than 440,000 beetles were taken during the summer and the maize crop was not noticeably injured. The smallness of the damage may have been due to the destruction of many beetles by diseases and the frequent and heavy rains. The cost for 15 light traps was from 1*s*. to 1*s*. 3*d*. a day. The numbers of males caught exceeded the number of females. This is the normal condition, and if, as has been suggested, the beetles are polyandrous, there may be an advantage in catching a large number of males. Females of the more common species formed a larger percentage of the catch in the early part of the season than did males.

In the biological experiments undertaken to investigate the habits of white grubs, glass cages were used in which earth was placed between

two vertical glass plates less than half an inch apart. The cages were shielded from the light except at the moment of examination By regulating the distance between the plates, larvae of any size could be viewed from at least one side. The results were as follows :—(1) No daily migration was observed ; movements and feeding occurred only in warm weather, activity reaching a maximum during the heat of the day ; the optimum temperature was between 60° F. and 65° F. (2) The food apparently consisted entirely of the roots of plants. (3) Larvae were reared from 5th May to 18th July in soil without apparent food ; the soil was then allowed to dry and on 22nd October two larvae were alive and active ; starvation methods for control are therefore useless. (4) Poisoned bran mash was not eaten by the larvae and was thus of no value. (5) Sodium arsenite, into which grass roots were dipped before planting, resulted in the death of 22·2 per cent. of larvae in four days ; no injury to the grass was observed. Corrosive sublimate used on one plant caused a mortality of 50 per cent., but the plant died, since the roots were entirely eaten. (6) Kerosene emulsion and Black Leaf 40, at the ordinary strengths, were useless. (7) Creosote acted as a repellent and did not injure the treated plants. In the control pots a mortality of 15·9 per cent., due to bacterial and other diseases, was observed. Results in connection with temperature and nature of food supply seemed most significant.

DAVIS (J. J.). **A Progress Report on White Grub Investigations.**—*Jl. Econ. Entom., Concord*, ix, no. 2, April 1916, pp. 261-281, 3 plates, 1 table.

Lachnosterna investigations carried out at Lafayette, Indiana, have included a study of the life-history, habits and embryology of various species, and a determination of the distribution of species throughout the country in relation to soil, timber, farming methods, etc. *L. tristis* invariably has a two-year cycle in the latitude of Lafayette, while *L. arcuata*, *L. fusca*, *L. vehemens*, *L. rugosa*, *L. ilicis*, *L. grandis*, *L. fraterna*, *L. hirticula*, *L. inversa*, *L. bipartita*, and *L. congrua* have a three-year cycle. *L. crenulata* and *L. crassissima* usually require three years for development, but this may be extended to four years, while the normal three-year cycle of *L. gibbosa*, *L. burmeisteri* and *L. implicita* may be reduced to two years. The length of the life-cycle is influenced by latitude, increasing in the more northern States and decreasing in the more southern. In the latitude under consideration, the life-history of the economic species of *Lachnosterna* is as follows :—The eggs are laid singly in balls of earth in soil covered with grass or small grain ; more than 50 eggs are deposited by each female. The larvae feed on young roots and decaying vegetation until autumn, when they go deeper down and hibernate in a special cell. Activity is resumed in May and continues until the beginning of October, when hibernation occurs. In the spring of the third year, feeding continues until the beginning of June, when the pupal cell is formed. The prepupal stage lasts about two weeks and the pupal from three to four weeks. Adults emerge from the soil at the end of April or beginning of May in the fourth year. The most severe injury occurs during the second year, but in northern Wisconsin, where the life-cycle is extended by one year, damage occurs during the two seasons following the year of oviposition.

In southern Indiana and other southern States, larvae of *L. burmeisteri*, *L. quercus*, *L. antennata*, etc., which pupate in spring, emerge as adults during the same season, in June or July. The related species, *Ligyrus gibbosus* and *L. relictus*, require one year for development. The larvae feed on manure and other decaying matter, but the adult of *L. gibbosus* attacks the roots of *Amaranthus* and *Helianthus* and may cause some damage. *Cyclocephala immaculata* may become a serious field pest, attacking the same crops as *Lachnosterna*. It has a one-year cycle; pupation takes place in spring and adults emerge in June and July. *Cotalpa lanigera* is of importance in some districts, since it injures raspberries, strawberries, maize, grass, etc. The life-cycle occupies four or five years. *Polyphylla variolosa* in New Jersey has a similar life-cycle to that of the preceding species. The distinguishing characters of the larvae of *Lachnosterna* and the above-mentioned related species are described.

Field observations have shown that some species of *Lachnosterna* occur at certain elevations, others where certain soil conditions exist, and others where a particular food-plant is available. *L. tristis*, *L. hirticula* and *L. fraterna* feed in the adult stage on hickory and oak, *L. fusca* on ash, while *L. gibbosa* is a general feeder. Most species prefer a clay-loam soil, but *L. prunina* occurs only on sandy ground. The time and duration of the period of flight varies. *L. gibbosa* appears early in spring and is present throughout the summer. *L. arcuata* and *L. fusca* disappear late in June, and after the beginning of July, very few individuals of any species are found. In southern Indiana and further south, *L. ephilida*, *L. burmeisteri*, *L. quercus*, *L. gracilis*, etc., are present from June until August. In Utah, Idaho and Montana, *L. dubia* is most important, in South Dakota, *L. vehemens*, in north-eastern Iowa, south-western Wisconsin, and north-western Illinois, *L. fusca*, etc.

The most serious outbreaks were those of 1912 and 1915. The natural enemies appear to be increasing in numbers and may in future control any serious outbreak. The most effective insect enemies of the larvae are *Tiphia* spp. and Asilids. The life-history of two species of *Tiphia* has been determined; in both cases it lasts one year; the eggs are deposited on the surface of the host, the females being parthenogenetic; the winter is passed in the larval stage within the cocoon. *Elis 5-cincta* is an important enemy in some districts. The life-cycle occupies a year; it is not parthenogenetic, and differs from *Tiphia* in that it paralyses the host completely during the act of oviposition. Three Tachinids parasitic on the larvae are *Microphthalma disjuncta* in the central States, *M. pruinosa* in New England, and *Ptilodexia tibialis* in Texas. The Asilid, *Promachus vertebratus*, has been reared from larvae feeding on white grubs, and is common in some parts of Wisconsin. *P. fitchii* occurs in the eastern states and both this and the preceding species have a three-year life-cycle. Predaceous Carabid beetles and their larvae are important as a controlling factor. Other enemies of minor importance are the Pelecinid, *Pelecinus polyturator*, the Ichneumon, *Ophion bifoveolatum*, and the Bombyliid Fly, *Sparnopolius fulvus*. The following Dipterous parasites have been reared from the adult:—*Pyrgota undata*, *P. valida*, *Cryptomeigenia theutis*, *Eurixa exile* and *Biomyia lachnosternae*. Miscellaneous enemies include spiders

attacking the adult and mites, skunks, opossums and blackbirds, attacking the larva. Fungus diseases due to *Cordyceps* and *Metarrhizium anisopliae*, and bacterial diseases have not proved effective in controlling these beetles Two outbreaks of white grubs in Illinois in 1912 and 1915 respectively were effectively controlled in some localities by a protozoan parasite. At Lancaster, Wisconsin, a disease due to a Nematode was prevalent in some fields in 1915. Artificial methods of control include (1) the utilisation of farm animals, such as pigs, chickens and turkeys, after ploughing; (2) early ploughing, as soon as possible after 15th July, during the year in which the larvae are transforming into pupae; (3) crop rotation; a rotation of oats, clover and corn has proved satisfactory in some districts; oviposition does not take place on clover, nor are small grain crops seriously injured by the larvae. The crops should be arranged so that timothy and small grain do not occur when beetles are abundant, while susceptible crops should be planted in land which was thoroughly cultivated during the flight of adults. The collection of adults by a trap lantern or the spraying of trees with arsenicals would be effective if carried out by entire communities instead of by isolated individuals.

BRITTON (W. E.). **Further Notes on *Diprion simile*, Hartig.**—*Jl. Econ. Entom., Concord,* ix, no. 2, April 1916, pp. 281–282.

Lophyrus pini, L. (*Diprion simile*, Hart.) has been recorded in Connecticut in five widely separated localities, two of which adjoin New York State, where this sawfly may soon be expected to appear. Control measures include summer inspection for collecting larvae, spraying of infested trees with lead arsenate, and collection of cocoons in autumn and winter. During 1915, two complete generations were reared and males of the third generation emerged in late autumn. The average duration of the larval stage was 30½ days. The broods showed considerable overlapping and were somewhat irregular; some over-wintering pupae did not produce adults until after the first generation of larvae had matured. Eggs failed to hatch on dry twigs. Unfertilised eggs produced normal larvae and pupae. Newly hatched larvae were unable to feed on Austrian pine, but after the first instar were able to complete development on this tree. Over-wintering cocoons were parasitised by the Chalcid, *Pachyneuron nigrocyaneus*, Nort., to the extent of 31 per cent. The Tachinid, *Exorista petiolata*, Coq., the Ichneumon, *Hemiteles utilis*, Nort., and the Chalcid, *Cerambycobius* sp., were also obtained from the cocoon, and Tachinid eggs were common on the larvae.

HOUSER (J. S.). **A New Method of Subterranean Fumigation.**—*Jl. Econ. Entom., Concord,* ix, no. 2, April 1916, pp. 285–287.

The experiments recorded in this paper were carried out in Cuba against the ant, *Atta insularis*, which causes serious injury to many plants, especially citrus trees. The leaves are carried by the ants into the galleries of the nest, where they serve as media for the growth of the fungus gardens, and trees may be completely defoliated as the result of attack. The usual methods of control are :—(1) The digging out and burning of the nest; this is expensive and only moderately

successful; (2) fumigation with carbon bisulphide, the liquid being poured into openings of the nest; the weakness of this method lies in the fact that the liquid is quickly absorbed by the soil and the fumes are liberated too slowly to be efficient; (3) fumigation with sulphur dioxide; here also some of the fumes escape as soon as pressure is released, since the compound is lighter than air. The method used by the author was that of forcing vaporised carbon bisulphide into the ant-hill. A jet of air was liberated at the bottom of an enclosed volume of carbon bisulphide. The mixture of air and bisulphide vapour was passed through a tube out of the generator and into the galleries of the nest. In laboratory tests workers ceased movement in 33 seconds and soldiers in a slightly less time. In the field, about 2 litres of bisulphide were used in a day. This method appears to be more rapid, convenient and to give more lasting results than the sulphur dioxide method. It should be tested in other districts in which leaf-cutting ants occur and its effectiveness against other earth-dwelling insects requires to be investigated.

TALBERT (T. J.). **Some Work of the Extension Entomologist in Kansas and Missouri.**—*Jl. Econ. Entom., Concord,* ix, no. 9, April 1916, pp. 287-290.

The chief duty of the extension entomologist is to acquaint the gardeners and farmers with facts concerning the habits, life-histories, injuries and control of insects. Field meetings and demonstrations have proved to be exceedingly valuable, since the insects can then be studied under natural conditions upon their food-plants. During June 1915, *Meliana albilinea*, Hb. (wheat-head army worm) appeared in injurious numbers in central Kansas. The author visited infested districts and was able to describe the habits and life-history; he suggested the use of poisoned bran mash as a control measure. Many acres of wheat were saved in this way. An outbreak of the Hessian fly [*Mayetiola destructor*] in Missouri during August and September was controlled by similar measures.

HASEMAN (L.). **An Investigation of the Supposed Immunity of some Varieties of Wheat to the Attack of Hessian Fly.**—*Jl. Econ. Entom., Concord,* ix, no. 2, April 1916, pp. 291-294.

The Hessian fly [*Mayetiola destructor*] has been abundant in the Mississippi Valley during the past few years and has caused severe losses every year among wheat growers. Preliminary investigations were carried out in 1915 to determine whether the fly breeds more abundantly on some varieties of wheat than on others, or whether certain varieties are able to resist attack better than others. Three varieties of wheat were used, namely, Fultz, Fulcaster, and a supposed immune form. Infested self-sown wheat was introduced among these. Examination a month later showed the following amount of infestation:—Fultz, 2·72 per cent.; Fulcaster, 1·46 per cent.; and supposed immune form, 1·7 per cent. A second examination showed that Fultz was again more heavily infested than the other two varieties. It therefore seems proved that some varieties are more severely

attacked by the fly than others. Determinations were made of the ash content of young and mature straw to find out whether it differed in the three varieties and whether it might be a factor in repelling the fly. The ash content was found to differ and the extent of infestation seemed to vary directly with it. The yield of Fulcaster was much greater than that of the other two varieties, but part of the extra weight may have been due to the fact that it is a bearded form.

Investigations are being continued this year on a larger scale, early and late sowings of several varieties having been made to observe the effect of such sowings on the fly and on the wheat itself as regards winter injury.

HARNED (R. W.). **The Small Pink Corn Worm (*Batrachedra rileyi*, Wals.) in Mississippi.**—*Jl. Econ. Entom., Concord*, ix, no. 2, April 1916, pp. 295–298, 2 figs.

Batrachedra rileyi, Wals., caused serious damage to maize over a limited area in central Mississippi in the autumn of 1914. In 1915 the damage was less in the central counties, but was found to have spread to other parts of the State. In both years larvae were found in every field examined, the number of ears infested varying from 10 to 99 per cent. Larvae appeared to be more numerous in maize grown on hill lands. Early maturing maize usually contained fewer caterpillars than late varieties. Stored maize was generally severely infested during November and December, but few larvae were present as late as 1st April. Larvae were most numerous in ears which had been damaged by other insects and in imperfect ears, but they also occurred in those which were otherwise healthy. Infestation was greatest at the tips of the ears, though other parts were also affected. A temperature of less than 10° F. in January 1915 caused a considerable diminution in the number of the caterpillars. In feeding, the larvae either attacked grains which had been partly devoured by other insects, or tunnelled through or between fresh grains. Sorghum and kafir corn were badly infested in July and August 1915.

TAYLOR (J. E.). **Coöperation in the Establishment of State Quarantines.** *Jl. Econ. Entom., Concord*, ix, no. 2, April 1916, pp. 299-303.

For the effective working of State quarantines the closest coöperation must be established between affected States and the effect of such quarantines on well-established lines of commerce be considered before they are promulgated. The establishment of arbitrary quarantines, especially when they affect commerce, is liable to lead to retaliatory measures being adopted by commercial interests and increases the danger of spreading a pest. The facilities at the disposal of most State quarantine officers are inadequate to meet commercial interests affected by quarantine measures. It is therefore important that the various States threatened with attack by insect pests or plant diseases should act together to prevent invasion. The author describes the quarantine measures established against the State of Utah by Arizona, California, Idaho, Montana and Oregon, on account of the lucerne weevil [*Hypera variabilis*]. In his opinion none of these quarantines are justifiable, nor is any State gaining protection from the

weevil by this means. The only means of spreading the weevil is by shipping lucerne hay or any product which has been in contact with it between 15th July and the beginning of winter, though there is no record in which such transportation of the weevil has occurred. Early potatoes, which may be a source of danger in this respect, are so easily handled that all risk may be eliminated. The restrictions placed on the export from Utah into some or all of the States above mentioned of nursery stock, fruit, vegetables, lucerne seed and live stock, are thus unjustifiable and have caused serious financial loss.

BENSEL (G. E.). **Control of the Variegated Cutworm in Ventura County, California.**—*Jl. Econ. Entom., Concord*, ix, no. 2, April 1916, pp. 303-306, 3 plates.

Lycophotia (*Peridroma*) *margaritosa* is widely distributed in Ventura County. Serious outbreaks occurred in 1913 and 1914, when the sugar-beet crop was completely destroyed in some districts. Feeding was observed to take place at night and in the early morning and activity was greatest during cool and foggy weather. The natural enemies found were *Calosoma semilaeve*, Lec., *C. cancellatum*, Esch., and the Ichneumonid parasite, *Henicospilus purgatus*, Say. Among the artificial methods of control to which resort was made, the rolling of young beets was successful in some cases. If the plants were completely destroyed, it was found best to replant after three or four weeks. A spray consisting of 2 lb. Paris green to 50 U.S. gals. water, with the addition of 1 lb. molasses, was applied two or three times at intervals of four days. The voracity of the cutworms diminished considerably after the second application. The cost was about 4*s*. per acre for each spray. The application of dry Paris green by means of a special arrangement on an ordinary horse cultivator was tested. By this method the poison was somewhat unevenly distributed, but the extra cultivation stimulated the plants to more rapid growth. The spray was given in early morning. Cattle were fed with the tops of sprayed beets during the summer without injurious effects being observed. The author recommends that ditches, about 1½ feet deep, be dug round adjoining fields, since under certain conditions the cutworms may acquire the marching habit. Adults were trapped by means of arc lamps of 3,000 candle power, at an approximate cost of 1*s*. 3*d*. a night. The lamps were placed in shallow pans about 4 feet in diameter set on a platform 6 feet above the ground. The pans contained water covered with oil. About 1,000 moths were captured in each pan on warm, dark and still nights, 22 per cent. being gravid females. This method of control caused a marked diminution in the numbers in the affected districts.

BACK (E. A.) & PEMBERTON (C. E.). **Parasitism among the Larvae of the Mediterranean Fruit-Fly** (*C. capitata*) **in Hawaii during 1915.**—*Jl. Econ. Entom., Concord*, ix, no. 2, April 1916, pp. 306-311, 3 tables.

The observations described in this paper form a continuation of the work carried out in 1914 in connection with the percentage of parasitism among the larvae of *Ceratitis capitata*. [See this *Review*, Ser. A,

iii, p. 412.] Specimens of *Opius humilis* and *Diachasma tryoni* were liberated in the Kona coffee district on 13th June 1913; the former species was liberated in Honolulu in December 1913 and the latter early in 1915. *Tetrastichus giffardi* was liberated between 27th October and 21st December 1914 on the Island of Oahu and in the Kona and Hilo districts of Hawaii, and a few specimens of *D. fullawayi* on Oahu and in the Kona district. Further liberations of the last-named species were made in 1915. The percentages of parasitism of *D. fullawayi* and *T. giffardi* recorded represent the establishment and control exerted by these parasites during the first year after their liberation in Honolulu and the Kona district; those of *O. humilis* and *D. tryoni* represent the control exerted by these two parasites during their second year after establishment in the Kona district, but in Honolulu during the second year of *O. humilis* and the first year of *D. tryoni*. In the Kona district, no specimens of *T. giffardi* were reared from larvae of *C. capitata* developing in coffee berries, although large numbers of the parasite were liberated. One specimen of *D. fullawayi* was bred from larvae collected in coffee in January. A gradual change was observed in the ratio of control exercised by *O. humilis* and *D. tryoni* in the coffee section during March, June and September. *D. tryoni* increased in effectiveness, but at the expense of *O. humilis*. The percentages of parasitism among larvae developing in kamani nuts in Honolulu showed fewer negative results than those recorded in 1914. *D. fullawayi* appeared to be very efficient in parasitising larvae in coffee and may become of more value than *O. humilis*. *T. giffardi* may prove valuable in supplementing the work of *O. humilis*, *D. tryoni* and *D. fullawayi*, which species are most active in attacking mature larvae while the host fruits are still attached to the trees. They have not been observed to oviposit in larvae within fallen fruit, while *T. giffardi* has been taken in channels of fruit-fly larvae in decayed kamani nuts. Laboratory observations have also shown that the female of *T. giffardi* will enter kamani nuts through breaks in the pulp and attack the larvae within. During the warmer seasons, when larval development and emergence is rapid, the heaviest parasitism has been found among larvae emerging during the first day or two after the fruit has been gathered. *T. giffardi* will probably be able to parasitise, as they become mature, those larvae which were either unhatched or very young when the host fruit fell from the tree. The data for 1914 and 1915 show that the four parasites have become successfully established and promise to be an important factor in the control of *C. capitata*.

COCKERELL (T. D. A.). **Some Grass-Feeding Mealy-Bugs** (COCCIDAE).—*Jl. Econ. Entom., Concord*, ix. no. 2, April 1916, pp. 312–313.

Pseudococcus timberlakei, sp. n., was collected from salt marsh grass at Millbrae, California, on 14th October 1915. Immature specimens and females with egg-masses occurred on the leaf-blades or in the leaf-axils. *P. neomexicanus*, var. *utahensis*, var. n., was obtained from *Elymus* in Salt Lake City in August, September and November. The specimens were concealed between the sheaths and the stem. *P. neomexicanus*, common in northern New Mexico, lives on the roots of grass and is attended by a species of *Lasius*.

CHITTENDEN (F. H.). **The Pink Corn-Worm: an Insect destructive to Corn in the Crib.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 363, 8th May 1916, 20 pp., 7 figs., 4 plates.

Batrachedra rileyi, Wals. (pink corn-worm) is most abundant in Mississippi but also inhabits the States bordering the Gulf of Mexico, Arkansas, Tennessee, South Carolina and Georgia. It has also been recorded in Hawaii. The first reports of serious injury were made in Mississippi in 1914, when maize was severely attacked. This moth appears to be confined to maize and sorghum among cereals; cotton bolls that are more or less open may be slightly damaged, and in Hawaii it has been recorded on lantana, palm, *Pandanus*, banana, etc. On maize, the worm attacks the kernel, the husk and the cob. Injury begins in the field and continues after the maize has been stored. When the stored product is husked, infested ears show accumulations of webbing and excreted matter. The eggs are deposited in the field in ears which are more or less open at the tips owing to previous injury by *Chloridea* (*Heliothis*) *obsoleta* (corn-ear worm). Larvae hatching from the eggs penetrate the seeds at the point of attachment, destroy the embryo, and emerge through the exposed portion of the seed. This species usually follows the attack of *C. obsoleta*, F. The following have been found associated with *B. rileyi*:—*Calandra oryza*, L. (rice weevil), *Sitotroga cerealella*, Zell. (Angoumois grain moth), *Cathartus gemellatus*, Duv. (square-necked grain beetle), *Contarinia sorghicola*, Coq. (sorghum midge), the Arctiid moth, *Celama* (*Nigetia*) *sorghiella*, Riley, *Cathartus advena*, Walt. (foreign grain beetle), *Araecerus fasciculatus*, de G. (coffee-bean weevil), and the Ortalid fly, *Euxesta anonae*, F.

The natural enemies of *B. rileyi* are probably predaceous nocturnal birds and bats and an Ichneumon, *Pimpla* sp., was bred from larvae in cotton bolls in Texas. As a preventive of injury, maize should not be left in the field longer than is necessary for drying it; the husks should then be removed as soon as possible, infested ears destroyed or fed to swine or poultry and the remainder fumigated with carbon bisulphide (2 or 3 lb. per 1,000 cubic feet of space). Bins should be fumigated before being filled with new material. Cooperation among growers should be secured so that future losses may be prevented.

SACHAROV (N.). **Карадриновая или помидорная совка и мѣры борьбы съ нею.** [*Laphygma* (*Caradrina*) *exigua*, Hb., and its control.]—**« Сельско-Хозяйственный Вѣстникъ Юго-Востока.»** [*The Agricultural Herald of the South-East*], *Saratov*, no. 3, 14th February 1916, pp. 5–9, 4 figs. [Received 9th May 1916.]

The Noctuid, *Laphygma* (*Caradrina*) *exigua*, Hb., occurs in southern Europe, England, the western and south-eastern governments of Russia, America, Egypt, the Sudan, India, Asia Minor, Syria, Armenia, Japan, China and the Canary Islands. In southern Europe, the caterpillars injure maize and potatoes; in America, cotton, maize and beet; in Egypt, cotton, lucerne, maize and sugar-cane; in the Sudan, lucerne; and in India, lentils, cabbages and indigo. In Russia, it has been reported to attack onions, and in Turkestan lucerne, cotton and sugar-beet. In Astrachan, it is a very serious pest of market gardens, injuring tomatoes, capsicum, onions, egg-plants, peas, salad, beet, summer

cabbage, potatoes and seedling wheat, and also feeds on some wild plants. The last occasion when a serious outbreak of this pest occurred in Astrachan was in 1911, when great damage was done to capsicum and tomatoes; of late years it has again increased and an outbreak may be expected in the near future. Owing to the great local importance of these two crops, a special study has been made of this pest in relation to them. Although the life-cycle from egg to imago lasts only 37–42 days, only three generations occur in Astrachan. The first or spring generation lasts till the end of June, the second till the middle of August, and the third during August and September. Only the first two generations are of importance in the local market-gardens, the harvest being practically over by August. Hibernation probably takes place only in the pupal stage and adults present in the autumn do not survive the winter. The eggs are laid in heaps on the foliage but not on the fruit. They hatch in five or six days and the larval stage lasts 20–22 days, pupation taking place in the soil and the adult emerging in 12–14 days. Two Hymenopterous parasites of this moth were found, but not identified; one of these also attacks the caterpillars of *Barathra* (*Mamestra*) *brassicae*, L. Caterpillars of other Noctuids observed on tomatoes and capsicum included those of *Euxoa segetum*, Schiff., *Polia* (*Mamestra*) *oleracea*, L., *Scotogramma* (*M.*) *trifolii*, Rott., and *Agrotis c-nigrum*, L.

Any arsenical insecticide can be used effectively against the young caterpillars, whilst they are feeding on leaves and good results were obtained with Paris green (½ lb. of green, 1 lb. of lime in 40 gallons of water). The first spraying must be done 8–12 days after the planting of tomatoes and capsicum; the second about a month afterwards; the third in August. The control of fungus diseases attacking tomatoes may be effected at the same time by spraying with a mixture consisting of copper sulphate, 4 lb.; lime, 3 lb.; Paris green, ½ lb. in about 40–45 gallons of water.

«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.» [*Proceedings of the Conference on pests of clover in Central Russia.*]—**Тульская Губернская Земская Управа. Энтомологическая Станція.** [The Uprava (Executive) of the Zemstvo of the govt. of Tula. The Entomological Station], *Tula*, 1916, 248 pp.

This conference, convened by the Zemstvo of the government of Tula, and took place in April 1915 was attended by a number of the heads of Entomological Stations, representatives of the Ministry of Agriculture, etc. Clover is the principal forage crop in Russia and according to the last available figures, which are those for 1911, some 4,300,000 acres of this class of crop were cultivated in European Russia, of which a little over 62·5 per cent. were under clover. Since then, these figures must have been largely exceeded, as in Central Russia the cultivation of clover increases yearly.

After some papers on the fungus and bacterial disease of clover, the following on the insect pests of this crop were read and discussed at the conference :—

SOPOTZKO (A. A.). **Вредители клевера въ Тульской губерніи въ 1910-14 г.г.** [Pests of clover in the govt. of Tula during 1910–14.] —**«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 115–145.

The most serious pests of clover are those which attack the seeds. During 1910–1913, species of *Apion* were principally responsible for the bad harvest. This paper details the author's observations as to these pests since 1911, including matter already contained in previous reports [see this *Review*, Series A, i, p. 483, A, iii, p. 634 and A, iv, p. 167]. These weevils, which winter as adults, feed during the whole of their life on leaves of clover, though the direct damage done to the foliage in this way is not great. The life-history of *Apion* is closely adapted to the peculiarities of the growth of clover, which is continually forming new heads throughout the whole summer, and therefore oviposition can proceed continuously, but as at any given moment there is only a limited number of heads suitable for oviposition, each female lays only one egg at a time. Amongst the remedies suggested is the cutting of clover in the middle of June. This crop should be kept for seed, and not the second or aftermath as stated in a former paper [see this *Review*, Ser. A, i, p. 483]. Other remedies include the destruction of the larvae and pupae by stacking the clover hay before it is dry and thus causing heating, and the disinfection of the hay in pits with carbon bisulphide, as recommended by Portchinsky. No remedy, however, will give complete results, unless accompanied by the control of the insects on wild clover, which must be repeatedly mown while in flower and the cut material destroyed, or sprayed with Paris green. Other pests of clover include a species of *Hypera* (*Phytonomus*), the larvae of which live inside the clover heads, injuring the ovaries and devouring the flowers. The adults appear somewhat later than those of *Apion* and feed on the leaves in which they eat larger holes. The larvae pupate in the corolla, the pupal stage lasting seven days. A comparative table showing the degree of infestation of clover by *Hypera* and *Apion* is given, showing that the latter is much more prevalent. The caterpillars of *Cydia* (*Laspeyresia*) *compositella*, L., were also found on clover heads, mining the base of the flowers; in 1912 they were more numerous in the second half of the summer. The insect winters in the pupal stage and there are two generations, the adults being on the wing in May and again in July. The larvae of *Perrisia* (*Cecidomyia*) *trifolii*, L., are also sometimes found in the heads of clover, but in small numbers; two generations occur, the flies being on the wing after the end of May and again after the middle of July; the nature of the damage done by this pest is uncertain. *Sitones lineatus*, L., *S. flavescens*, Marsh., *S. puncticollis*, Steph., *S. hispidulus*, F., *S. crinitus*, Ol., and allied species, though mostly found on vetches, also injure clover. The caterpillars of *Polia* (*Mamestra*) *pisi*, L., were found in 1912 in great numbers on one estate injuring leaves of clover; about 90 per cent. of them perished in August from flacherie. Larvae of

Tipula flavolineata, Mg., attacked clover in 1911 and 1912 in several localities. Adults and larvae of *Agriotes lineatus*, L., *A. sputator*, L., and *A. obscurus*, L., were constantly found in the soil of clover fields. It has not yet been ascertained how far they are injurious to this crop.

SHTCHERBAKOV (Th. S.). **Перспективы изученія клевера съ точки зрѣнія опытно-энтомологической.** [The possible results of the studies of clover from an experimental-entomological point of view.]—**«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 154–181. [See this *Review*, ser. A, iv, p. 142.]

The above two papers provoked a great deal of discussion. The views expressed were finally embodied in the resolution adopted by the conference, which states that amongst the factors responsible for the decline in the cultivation of clover, a prominent place must be assigned to insect and fungus pests, and that the necessary further researches must proceed by way of the biological-ecological and agricultural-statistical methods. The first of these is defined, as consisting not only of the study of the life-history of the pests in connection with various external influences, but also of the study of the physiological processes of the insect organism, particularly those connected with stages in its life-history against which the various methods of control are directed. The second method must be based on comparative data for several years and be applied according to the recognised rules of the science of agricultural statistics. Special attention should be paid to those varieties of clover which appear to be insect-and fungus-proof. E. M. Vassiliev emphasised the necessity of paying more attention to the insects which attack the roots of clover, amongst which he instanced the larvae of *Otiorrhynchus ligustici*, L.

GORIAINOV (A. A.). **О вредителяхъ клевера въ Рязанской губерніи.** [On pests of clover in the govt. of Riazan.]—**«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 146–150.

Pests of clover in Riazan include :—*Apion apricans* and *A. aestivum* (*trifolii*), which are very prevalent. In many cases Chalcids were reared from the clover heads. *Bruchophagus gibbus*, *Sitones* sp., *Scotogramma* (*Mamestra*) *trifolii*, and *Polia suasa* (*M. dissimilis*) were also present.

MIZEROVA (F. V.). **Вредители клевера въ Орловской губерніи въ 1913-14 г.г.** [Pests of clover in the govt. of Orel according to observations in 1913–14.]—**«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 151–153.

The following pests of clover are given in this paper :—*Apion aestivum*, Germ., *A. apricans*, Herbst, *A. flavipes*, Payk., *Bruchophagus*

gibbus, Boh., *Tetranychus telarius*, L., *Sitones lineatus*, L., *S. puncticollis*, Steph., *Hypera* (*Phytonomus*) *meles*, F., and another unidentified species., *Haltica* beetles, *Agriotes*, *Athous*, *Cecidomyia*, *Agromyza*, *Cydia compositella*, F., *Scotogramma* (*Mamestra*) *trifolii*, Rott., *Polia* (*Mamestra*) *pisi*, L., *Euxoa* (*Agrotis*) *segetum*, Schiff., *Phytometra* (*Plusia*) *gamma*, L., thrips and Aphids.

TOPORKOV (S. G.). **Культурные методы борьбы съ клеверным долгоносикомъ.** [Methods of cultivation as remedies against the clover-weevil].—**«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 182-186.

In the system of crop rotation prevailing in the government of Tula, clover usually occupies a given field for two years; one part of the crop being used for hay and the other for seed. The fields are only harrowed in the spring and afterwards remain without further cultivation. Favourable conditions are thus created for the hibernation of beetles. The mixed cultivation of clover for hay and seed allows the insects, after the removal of the hay harvest, to concentrate and breed on the remaining plants. Clover for hay should therefore be kept separate from seed-clover, the fields of the latter being as far as possible away from the former; fields of seed-clover should be deeply harrowed in autumn, after the harvest. Protective strips of unmown clover should be left round the hay-clover fields, on which the insects may oviposit and which can be afterwards cut for forage.

SOPOTZKO (A. A.). **Основанія положенія объединенія энтомологическихъ учрежденій Тульской, Орловской, Калужской и Рязанской губ. въ дѣлѣ изученія вредителей клевера и мѣръ борьбы съ ними.** [Principles for the coordination of the work of the Entomological organizations of the govts. of Tula, Orel, Kaluga and Riazan for the purpose of studying the pests of clover and their control.]—**«Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 187-191.

In view of the similarity of the conditions obtaining in the four governments mentioned the author recommends the co-ordination of the control of pests in them. To effect this, three or four observation posts should be established in each of the four governments, the work of which should proceed on identical lines, so that comparable results may be obtained; yearly conferences of the entomologists concerned should be held and a periodical publication on the pests of the whole region issued. The conference approved of these suggestions and it was also resolved to apply to the Department of Agriculture for a grant of £60 for the publication in question. In this connection the following paper was discussed.

SOPOTZKO (A. A.). **Проектъ програмы работъ практиканта на опытномъ полѣ по сбору матеріала по клевернымъ вредителямъ.** [An outline programme of work for assistants engaged in collecting material on pests of clover in the experimental fields.] — **« Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings on the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 206–211.

In order that the assistants in charge of the above-mentioned observation-points should as far as possible work on identical lines, the observance of the following rules is suggested :—1. Sweeping clover crops with entomological nets must be done everywhere the same number of times and at the same hours each day ; the temperature of the air must be taken before and after the sweeping and the data obtained must be classified in a similar way. 2. In taking samples for analysis, the field should be crossed on a diagonal, sample stems being taken alternately from right and left, at given intervals. 3. Analysis of the clover should include a description of the growth of the plants, the presence of fungus diseases, insect pests, etc. 4. Collection of weeds. 5. Catching of Noctuid moths in molasses and inspecting the traps each morning. 6. Catching honey bees and humble bees.

ADRIANOV (A. P.). **Желательныя работы по изученію проволочныхъ червей и мѣръ борьбы съ ними.** [Desirable work on the study of wire-worms and their control.]—**« Труды совѣщанія по вредителямъ клевера средне-русскаго раіона.»** [*Proceedings of the Conference on pests of clover in Central Russia.*] Published by the Entomological Station of the Zemstvo of the govt. of Tula, *Tula*, 1916, pp. 192–205.

This paper is a revision of the work done on Elaterid larvae in Russia [see also this *Review*, A, i, pp. 216, 485, ii, pp. 265, 372, 466, iii, p. 309 and iv, p. 162]. Biological questions which are not yet completely cleared up, include the food of the imago, the exact time of the pairing and oviposition, the interval between these two processes, the number of eggs laid at a time and in the aggregate, the duration of the egg-stage, the food of the young larvae, the number of moults, the duration of the larval stage, the identification of the larvae. As regards remedies, rolling cannot be expected to result in the destruction of the larvae, which are able to live in very hard and dry soil and to withstand starvation for a considerable time, but it is an open question whether this remedy does not create conditions in the soil rendering it impossible for the larvae to attack plants. Carbon bisulphide injections may prove too expensive, but further experiments are required in this respect, as well as in the use of poisoned baits, which involves much labour. Mineral manures have not proved effective up to the present. During the discussion on this paper, E. M. Vassiliev stated that Elaterid larvae begin to do damage earlier than is usually supposed and those of *Agriotes lineatus* attack the swollen seeds of maize in a very young stage. The oviposition period extends from early spring till June or July. In the opinion of A. Sopotzko the egg is the stage which is most easy to attack. E. M. Vassiliev stated that the eggs

are laid in fields covered with weeds and that by breaking up the soil their development may be checked. On one estate, instead of using poisoned potato-baits, potatoes were planted and the harvesting of these cleared the field of the larvae. N. M. Kulagin reported that, according to experiments carried out in the Government of Moscow by A. F. Baranov, the larvae perished quickly in dry basic slag, but survived for a long time if it was wet. Several speakers suggested the application of scientific methods of field cultivation, including proper rotation of crops, as adopted in Canada, and this view was accepted by the Conference, which also agreed with the author's conclusions as to the desirability of further investigations on this pest.

Tchikov (P. V.). **Краткое руководство по культурѣ табака примѣнительно для Сухумскаго Округа.** [A short guide to the cultivation of tobacco in the district of Suchum.]—**« Извѣстія Сухумской Садовой и Сельскохозяйственной Опытной Станціи.»** [*Bulletins of the Suchum Horticultural and Agricultural Experiment Station*], *Suchum*, no. 20, 1915, 16 pp. [Received 10th May 1916.]

The insect pests of tobacco recorded in the district of Suchum include *Gryllotalpa*, which injures the roots and can be controlled by means of poisoned maize baits (1 lb. of arsenic and 6 lb. of maize). The tobacco thrips, of which there are three generations during the summer and which is particularly abundant during droughts, should be controlled with sprays of tobacco extract. The caterpillars of *Euxoa segetum* also attack tobacco, injuring young roots and stems; early ploughing, destruction of weeds and handpicking are the remedies suggested.

Umnov (A.). **Враги сельскаго хозяйства изъ міра насѣкомыхъ.** [Insect-enemies of agriculture.]—**« Наше Хозяйство.»** [*Our Husbandry*], *Eletz (govt. of Orel)*, no. 5–6, 13th April 1916, pp. 15–20.

This article, evidently the first of a series, gives a short and popular account of the biology of wire-worms, with particular reference to *Agriotes lineatus*, L., and *Athous niger*, L. The author deals with the subject much on the same lines as in a previous paper [see this *Review*, Series A, ii, p. 263].

Anutchin (A.). **Турецкій скосарь.** [*Otiorrhynchus turca*, Bohem.] —**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 4, April 1916, pp. 201–202.

Otiorrhynchus turca, Boh., is a serious pest of the vine, devouring the buds in spring and later the leaves, while the larvae injure the roots. No males have yet been found, the females ovipositing parthenogenetically. The eggs are laid in the soil, where the larvae live and pupate. Beetles emerging from the pupae are able to oviposit the same summer; some of the eggs winter, others give rise to larvae of which some also remain over the winter, pupating next spring; some of the weevils also hibernate. Thus all stages of this pest may be found

at almost any time throughout the year. The usual remedies consist of smearing the buds with a mixture of lime and clay in soapy water, the destruction of the beetles by means of bait leaves wetted with sodium arsenite and placed underneath the plants, and spraying with barium chloride and molasses in summer.

Lutte contre les Sauterelles. [Locust control.]—*Rev. Hortic. de l'Algérie, Algiers*, xx, nos. 1-2, January-February 1916, pp. 31-34. [Received 9th May 1916.]

A circular dated 11th December 1915 instructs the local authorities in Algeria as to the control measures required against a probable invasion of locusts in the spring of 1916. The recommendations made are based on the experience gained in preceding campaigns. Immediately the appearance of the locusts is reported, the places where oviposition has taken place must be determined by the local authorities. This work must be supervised by a European who must watch for the emergence of the young locusts; these must be destroyed within eight to ten days of their hatching out. This is best accomplished by spraying with an 8 to 10 per cent. solution of cresyl. Even where the carriage of water is difficult and costly, spraying the young locusts will prove the most economical measure in the end. One operator can spray 66 gals. over 1¼ acres in a day. Spraying should preferably be done in the morning and in the evening. Where the above method is not capable of application, it will be necessary to burn the young locusts or to make use of the Ortel system. In the former case, heaps of grass, etc., must be arranged at the hatching places and the young locusts which have taken shelter in them may then be burnt. The Ortel system of trap-holes only gives good results in loose soil in regions where water and firing materials are lacking. The locusts are driven into circular holes measuring about 2 feet in diameter and in depth. The sides must be lined with zinc to prevent the insects from climbing out and the zinc must be wiped with an oily rag several times a day. When a hole is full the locusts must be crushed and removed. Whatever method of control is chosen, it is important that the long incubation period be fully utilised to make all arrangements and to bring up to the spot all the material required. Those who neglect control are subject to penalties. A special form has been distributed which is required to be filled in with information regarding the locusts, their control, etc. Under certain conditions the government provides supplies of cresyl; money grants are no longer made.

Trabut (L.). **Les sauterelles en 1916.** [Locusts in 1916.]—*Rev. Hortic. de l'Algérie, Algiers*, xx, nos. 1-2, January-February 1916, pp. 34-36. [Received 9th May 1916.]

It is probable that Algeria will be invaded in 1916 by the wandering locust (*Schistocerca peregrina*, Ol.) from the Sahara. Mechanical controls have proved unsatisfactory. Contact poisons, such as cresylates, heavy oils and polysulphides, are less effective than arsenicals. It is generally known among the natives that *S. peregrina* comes from distant regions and gives rise in the Algerian Sahara, in the high plateaux and in the Tell, to pink locusts which become winged in May, June, or July, according to the district, and are known as the

second generation. After doing some damage, this second generation migrates to the far south. Künckel d'Herculais has established the fact that it never oviposits in Algeria, while the locusts coming from the far south oviposit several times during their journey. These form the invading bands, and colonists in the Tell districts should know that the destruction of eggs and young locusts in the south of Algeria will not prevent invasion of the Tell districts. This incorrect idea has arisen from the confusion between *S. peregrina* and *Dociostaurus* (*Stauronotus*) *maroccanus*, which normally lives in the steppes of Algeria. Radically different control methods are required in dealing with these two species.

O bezouro dos cannaviaes. [The beetle of the cane-fields.]—*Chacaras e Quintaes, S. Paulo*, xiii, no. 4, 15th April 1916, pp. 248-249, 1 fig.

From early times *Ligyrus fossator*, Burm., has caused considerable losses in the sugar-cane growing States of northern Brazil. In the State of Pernambuco, especially in the Ipojuca Valley, it was customary when drawing up a contract for the letting of a cane-field to insert a clause exempting the tenant from the payment of rent in those years in which this pest appeared. The injection of carbon bisulphide and the flooding of infested land are the methods advised by Dr. Moreira. Against the larva the best method is the hoeing of the ground, care being taken to kill all the larvae found. An alternative method is the flooding of the ground prior to planting. Light-traps are the best measures against the adult beetles. In the case of all such larvae the following factor greatly aids control, providing as it does, an opportunity of destroying large numbers. When heavy rains inundate low-lying points, the larvae there will be suffocated where the soil is permeable. As the water recedes, the survivors return from adjoining points of refuge and follow it because they need moisture. When the bottom of the pool dries up entirely, large numbers of them will be found there. Straw should be heaped and burnt on these depressions which will destroy the larvae at the surface. To kill those which are buried, it is only necessary to flood this small area. If flooding is not possible, carbon bisulphide may be injected. By offering a small price for a given weight of larvae, large quantities could be collected. In Alagoas another Scarabaeid, *Ligyrus fossor*, Latr., has also appeared and requires the same control measures.

FEYTAUD (J.). **Recherches sur l'Eudémis et la Cochylis dans le Bordelais en 1913.** [Investigations on *Polychrosis botrana* and *Clysia ambiguella* in the Bordelais in 1913.]—*Ann. Service des Epiphyties, Paris*, ii (1913), 1915, pp. 109-152, 6 figs., 2 charts. [Received 11th May 1916.]

Whilst *Clysia ambiguella* caused little damage in the Bordeaux districts in 1913 owing to its set-back in 1911, *Polychrosis botrana* was responsible for losses estimated at about £1,600,000, in spite of the fact that the injury was very irregular in character from various causes. The developmental cycles of *C. ambiguella* and *P. botrana* in 1913 are dealt with in detail.

The second section of this paper deals with insecticides. Laboratory experiments on the action of milk of lime and on the comparative value

of zinc arsenite and lead arsenate were made. As previously observed, milk of lime kills the eggs of *Polychrosis*. Death appears to be due to dehydration or to tension, as the embryos continue to develop while the lime is drying, but die when dessication is completed. This hypothesis seems to be confirmed by the fact that the only eggs which hatched out were those which were already in an advanced stage when treated. As regards arsenicals, lead arsenate was again found to be the most efficient. It is however one of the most dangerous, adding the risk of saturnine poisoning to that of arsenical poisoning. Less deadly, but equally efficient substitutes have been sought for, and American entomologists have recommended ortho-arsenite of zinc. In the laboratory tests here described, it was found that the effect of lead arsenate and zinc arsenite is practically nil on the eggs of the vine-moth. The former produced no result, though the latter killed a few of the eggs. The remarkable aborting action of nicotine on the eggs [see this *Review*, Ser. A, ii, p. 410] is due to an internal insecticidal action on the developing caterpillars. The positive effect of nicotine and the negative effect of lead arsenate may be explained by the more rapid action of the former. Experiments on the caterpillars showed that zinc arsenite from 2½ to 3 per thousand is at least as efficacious as lead arsenate prepared with 3 per thousand of sodium arsenate, as in the following two formulae: (1) Anhydrous sodium arsenate, 3 parts by weight; neutral lead acetate, 9; water, 1,000; (2) anhydrous sodium arsenate, 3 parts by weight; neutral lead acetate, 9; copper sulphate, 20; lime, 10; water, 1,000. The following are the four zinc arsenite formulae given: (1) Zinc arsenite, 2½ parts by weight; gelatine, ¾; water, 1,000; (2) zinc arsenite, 2½ parts by weight; copper sulphate, 20; lime, 10; water, 1,000; (3) zinc arsenite, 2½ parts by weight; Marseilles soap, 3; water, 1,000; (4) zinc arsenite, 3 parts by weight; Marseilles soap, 4; water, 1,000. The trial of zinc arsenite in the vineyards is advocated.

Tests of insecticides in experimental plots confirmed the great efficiency of nicotined Bordeaux mixture and of wetting nicotine solutions, the high efficiency of pyrethrum, the lessened effectiveness of nicotine mixed with lime, and the inferiority of pyridine to nicotine. In the treatment of large vineyards, nicotined Bordeaux mixture saved a much greater value in grapes than the cost of this preventive treatment. The work done with bait-traps is reported in detail, many practical conclusions being reached [see this *Review*, Ser. A, ii, p. 359]. The natural enemies of *P. botrana* were an important control factor in 1913 in the Sauterne district, where most of the author's observations were made. For about ten years this district had been a centre of infestation, though little damage was done in 1913. Whilst this has been attributed to the use of bait-traps, it is essentially due to natural causes, such as the suppression of part of the first generation owing to the premature emergence of many adults and the action of natural enemies, including Ichneumonids and *Malachius*. An attempt was made to acclimatise the parasites of the American vine-moth, *Polychrosis viteana*, Clem., and eight species of parasitic Ichneumonids were received from the U.S. Bureau of Entomology, a list of which will be published later. Only two species were numerous enough for breeding purposes and one of these seemed to promise good results. Further trials are however necessary.

FEYTAUD (J.). **Note sur la cochenille oblongue, *Lecanium persicae*, et sur le traitement des vignes envahies par cet insecte.** [A note on *Eulecanium persicae* and on the treatment of vines infested by this insect.]—*Ann. Service des Epiphyties, Paris*, ii (1913), 1915, pp. 153–155. [Received 11th May 1916.

The Coccid now causing most injury in the vineyards of the Gironde is *Eulecanium* (*Lecanium*) *persicae*, found on various ligneous plants, especially the vine and the peach. The adult appears in May, lives during summer on the leaves and branches and in winter on the upper part of the stock. It attains full development in spring, when mating and oviposition take place. Its injury is intensified in spring and the loss of sap is sometimes great enough to wet the ground. *E. persicae* is found in abundance in the open vineyard. In the Médoc region the vines are painted or scrubbed with milk of lime or with a mixture containing lime and heavy oil. This is done in January and February, after pruning. Scrubbing serves the double purpose of scraping away some of the scales and covering others with the insecticide. Tests of both these substances were made, a soft brush being used, so that the results should be due solely to chemical action. Thick milk of lime was painted on pieces of vine covered with Coccids. This was done on 17th February; three or four days later the covering began to crack and lifted in places. On the 2nd March (13 days after application) some of these raised pieces were turned over and examined, when the scales were found to be alive, though imbedded in the lime except on the ventral portion which had been in contact with the plant. On 10th March (20 days after application) more than 50 per cent. of the Coccids were still alive, as was the case on the controls. Milk of lime did not appear to have any action of its own on the scales and where death was caused, it was apparently due to mechanical causes. The usual formula for heavy oil and lime contains 5 per cent. of heavy oil and 20 per cent. of quicklime. About 40 lb. of quicklime is sprinkled with the minimum quantity of water necessary to slake it. As soon as the lime is in powder, 10 lb. of heavy oil is poured on it and the mass is repeatedly stirred until, in about an hour, the oil is absorbed by the lime. The resultant greenish grey powder is mixed with 20 gals. of water. The covering of heavy oil and lime forms a pulverulent, yellowish green coating. As with milk of lime, the ventral surfaces of the scales are untouched, but the insects are very quickly killed by asphyxiation due to the heavy oil vapour. Treatment on 17th February killed all the scales by the next day. A piece of vine was washed in running water six hours after treatment and all the Coccids were found to be dead. Thus, rain falling on the day after treatment would not do any harm, as is the case when lime only is used, though the application should, of course, be made in dry weather.

PAILLOT (A.). **Les microorganismes parasites des insectes ; leur emploi en agriculture.** [Micro-organisms parasitic on insects and their employment in agriculture.]—*Ann. Service des Epiphyties, Paris*, ii (1913), 1915, pp. 188–232, 12 figs. [Received 11th May 1916.]

This paper is a valuable resumé of the history of investigations on beneficial fungi and other organisms infesting insects. In Russia in 1878 Metchnikoff began to investigate the fungi infesting *Anisoplia*

austriaca, one being a green Muscardine which he first named *Entomophthora anisopliae* and then *Isaria destructor* and which Vuillemin later placed in the genus *Penicillium*. Shortly afterwards the same species was found to infest the beetroot pest, *Bothynoderes* (*Cleonus*) *punctiventris*. The history of the study of fungi infesting *Locusta migratoria* is dealt with at length. Brongniart's fungus, called *Botrytis acridiorum* by Trabut and probably identical with that of Künckel d'Herculais which Giard called *Lachnidium acridiorum*, was said by him to cause epidemics in Algeria. The evidence as to the efficacy of this fungus and also of *Empusa grylli* in South Africa and elsewhere, is conflicting and probably much depends on the atmospheric conditions. In 1893 Giard studied *Isaria densa*, the Muscardine infesting the larvae of *Melolontha melolontha* and he also found this species to be virulent to the larvae of *Tenebrio molitor*, *Anomala frischii* and *Polyphylla fullo*, and to the caterpillars of *Acherontia* (*Sphinx*) *atropos* and *Sphinx ligustri*, as well as to those of various Noctuids, silk-worms, etc. It is however still uncertain whether this fungus provides an efficient means of combating these larvae. In the United States, between 1888 and 1896, interesting experiments were carried out with *Sporotrichum* (*Beauveria*) *globuliferum*, Speg., against *Blissus leucopterus* (chinch bug). In Snow's last report, issued in 1896, it is stated that *B. leucopterus* was affected by two fatal diseases due to *S. globuliferum* and *Empusa aphidis*, which are most virulent when the ground is damp and the air saturated with moisture. In 1910 Billings and Glen however concluded that the effect of this fungus on chinch bugs was uncertain. In 1903 Vaney and Conte obtained remarkable results in infecting *Haltica* larvae with *Botrytis bassiana*, but as a means of combating this pest it has not come into general use. In 1912 Picard artificially infected the caterpillars of *Phthorimaea operculella*, Zell., with the spores of *S. globuliferum*, *B. bassiana*, *Isaria densa* and *I. farinosa*. Negative results were obtained with *I. destructor*. Sopp described in 1911 the fungus control of *Dendrolimus* (*Gastropacha*) *pini*, a serious pest of conifers in Norway. By 1907 this pest had become so reduced as to be harmless, the principal fungus concerned being *Cordiceps norvegica*. In 1912 Speare and Colley published a work on the practical use of *Entomophthora aulicae* against *Euproctis chrysorrhoea*, and a year later Picard reported this fungus as causing an epidemic among the caterpillars of *Arctia caja* [see this *Review*, Ser. A, i, p. 250]. Much work has been done on the fungi infesting *Aleurodes* in Florida [see this *Review*, Ser. A, ii, p. 129; iii, pp. 22, 136], including *Aschersonia aleurodis*, *A. flavo-citrina*, *Aegerita webberi*, *Verticillium heterocladum*, which also attacks *Coccus hesperidum*, and *Sphaerostilbe coccophila*.

In 1893 Sauvageau and Perraud noticed that pupae of the vine-moths, *Polychrosis botrana* and *Clysia ambiguella*, were covered with a white fungus which Boudier identified as *Isaria farinosa*, Fries. Tulasne described this species as *Cordiceps militaris* and it is now known as *Spicaria farinosa* var. *verticilloides*, Fron. In spite of encouraging results, the experimental work was not continued until Schwangart in 1907 noticed that vine-moths did little damage in Franconia, where it is customary to bury the stocks in winter, and he found that by earthing them up from 85 to 90 per cent. of the pupae which had passed the winter in the ground were covered with a white fungus in the spring. While not applicable everywhere, this method

is worthy of attention, as it aims at aiding the natural development of the fungus, not at producing artificial epidemics [see also this *Review*, Ser. A, ii, p. 409]. The practical value of entomophytic fungi in controlling insect pests is still undecided, and the problem of producing at will a genuine epidemic which will spread of itself with sufficient rapidity to kill insect pests before they are able to cause loss, still remains unsolved.

Entomophytic sporozoites have not been studied to the same extent as the fungi. The most deadly epidemics caused by these micro-organisms have affected the silk-worm and the honey-bee, *Nosema bombycis* and *N. apis* being the respective sporozoites. Unsuccessful attempts have been made to cause pébrine epidemics in *Phylloxera* and among vine moths. Krassilstchik has reported a very deadly epidemic among the caterpillars of *Phlyctaenodes sticticalis*, due to *Microklossia prima* and *M. apiculata*. These species seem to be widely diffused among Lepidoptera, and Krassilstchik records *Polia (Mamestra) oleracea* as being infested to such a degree in Russia in 1902 that the development of its usual Tachinid and Ichneumonid parasites was rendered impossible. In 1907 Léger reported the presence of a new *Myxosporidium* in the Tenebrionid beetle, *Scaurus tristis*, Ol., from Algeria.

Entomophytic bacteria have also been but little studied. In 1892 Krassilstchik reported two diseases of the larvae of *Melolontha melolontha* in south Russia, viz :—Graphitosis caused by *Bacillus tracheitis sive graphitosis*, Krass., and septicaemia by *Bacillus septicus insectorum*. Infection could only be conveyed by inoculation. Some years before, Forbes had noted the existence in Illinois of a chinch bug disease due to *Micrococcus insectorum*, and Metchnikoff, when studying the fungi infesting the larvae of *Anisoplia austriaca*, found that many of them succumbed to a bacterial infection due to *Bacillus salutarius*. In 1911 d'Hérelle reported a deadly bacterial epidemic among *Schistocerca pallens* (Mexican locust) in Yucatan (Mexico), and much work has since been done with *Coccobacillus acridiorum* in Dalmatia, Turkey, Tunisia, at the Cape, in Colombia, Venezuela, and elsewhere [see this *Review*, Ser. A, i, pp. 162, 197 ; ii, pp. 95, 126, 335, 353, 462, 509, 681 ; iii, pp. 63, 118, 211, 293, 339, 399, 503, 682, 670, 699 ; iv, pp. 14, 45, 46, 48] which seems to point to its usefulness as a supplementary control to arsenicals. Chatton discovered *Bacillus melolonthae* in *Melolontha melolontha* and *B. bombycis* in the silk-worm. In 1913 Picard and Blanc discovered *B. cajae* and *B. lymantriae* in *Arctia (Chelonia) caja* [see this *Review*, Ser. A, i, p. 166] and *Lymantria dispar* [Ser. A. ii, p. 422]. The present author discovered *B. gortynae* in caterpillars of *Xanthoecia flavago (Gortyna ochracea)* and *B. pyrameis* in caterpillars of *Pyrameis cardui* [see this *Review*, Ser. A, i, p. 552].

The infections dealt with so far are due to known micro-organisms, but there are others, of an important and epidemic character, regarding the nature of which students are not agreed. The "grasserie" of the silkworm and the polyhedral wilt disease of *Lymantria monacha* (nun moth) belong to this category. In the United States Reiff attempted the artificial transmission, on a large scale, of the wilt disease (flacherie) to *Lymantria dispar* (gipsy moth). This agent has also been employed by other workers [see this *Review*, Ser. A, i, p. 33 ; ii, p. 101 ; iii, p. 549].

The concluding section of this paper deals with the symbiosis of micro-organisms with insects. In 1858 Huxley described a curious organ in Aphids which Karel Sulc in 1910 showed to consist of two parts, containing fungi of two different orders. Forbes described symbiotic organisms in *Blissus leucopterus*, in Lygaeids and Coccids, and they have also been described in Hemiptera, Hymenoptera and Lepidoptera, notably in *Pieris brassicae*. It has been observed that in certain instances *Isaria* fungi are symbiotic, while in others they are pathogenic to insects; according to Portier, the juices of the insect contain a substance which inhibits the development of the mycelium of the fungus while permitting the conidia to develop.

The valuable bibliography appended to this paper, gives a list of 157 works: 67 on entomophytic fungi, 26 on sporozoites, 16 on bacteria, 30 on diseases of unknown origin, and 18 on the symbiosis of micro-organisms with insects.

LESNE (P.). **Observations sur la mouche de l'asperge; essais de piégeage.** [Notes on the asparagus fly; Trapping experiments.]—*Ann. Service des Epiphyties, Paris*, ii (1913), 1915, pp. 266-272, 4 figs. [Received 11th May 1916.]

In 1913 *Platyparea poeciloptera*, Schrank (asparagus fly) in the Argenteuil district began hatching from asparagus stems on 25th March, 18 days earlier than the date observed in 1904 [see this *Review*, Ser. A, ii, p. 403]. This circumstance shows the advisability of burning dead stalks before the end of March. A case was noticed where stalks which had not been earthed up, were attacked and rapidly killed although they were of vigorous growth, thus demonstrating the importance of this operation. Trapping experiments were begun on 7th June with saucers filled, either with fermented cider and molasses, or with a mixture of wine and honey in equal parts. Many other insects were captured, but only one example of *P. poeciloptera* over a period of 10 days. These sugared bait-traps were therefore useless at this somewhat late date. Adhesives also proved ineffective. The best control would seem to be a search for its natural enemies in the normal habitat of this pest and their introduction into the districts where asparagus is grown.

VUILLET (A.). **Action des fumigations d'acide cyanhydrique sur le** *Diaspis pentagona*, **Targ.** [The action of hydrocyanic acid gas fumigations on *Aulacaspis pentagona*.]—*Ann. Service des Epiphyties, Paris*, ii (1913), 1915, pp. 285-287. [Received 11th May 1916.]

In experiments with hydrocyanic acid gas against *Aulacaspis pentagona*, ten tests were made with doses of potassium cyanide varying from about 2 to 4 grains per cubic foot, the mortality varying from 98 to 100 per cent. While absolute disinfection is not possible, this insecticide may be used to advantage in the case of imported plants. In no case should inspection on arrival be neglected and very heavily infested shipments should be destroyed.

Vayssière (P.). **Note sur quelques Coccides reçus à la Station entomologique de Paris en 1913.** [A note on some Coccids received at the Paris Entomological Station in 1913.]—*Ann. Service des Epiphyties, Paris,* ii (1913), 1915, pp. 288-301, 13 figs. [Received 11th May 1916.]

Eriococcus bahiae, Ehrh., was found in abundance on *Crithmum maritimum* in the island of Pomègue in the Gulf of Marseilles and on the neighbouring coast; up to the present this scale had only been reported in California. *Gymnococcus agavium,* Dougl., was found on *Agave* growing in the open air at Ventimiglia. On *Brachypodium ramosum* on the coast of the Gulf of Marseilles the author found a species of *Antonina* which he believes to be *A. purpurea,* Sign. *Coccus (Lecanium) viridis,* Green, on coffee, and *Diaspis boisduvali,* Sign., on coconut, were received from Guadaloupe. From the Blida Atlas, Algeria, *Diaspis visci,* Schr., taken on *Taxus baccata,* was received; this scale was also received from the Basses-Alpes (France), where it occurred on the twigs of *Wellingtonia.* In Tunis, *Aspidiotus hederae,* Vall., occurred on potatoes, on which it has not previously been noticed. *Pseudococcus nipae,* Mask., recorded from Bengal, appears to be the only other Coccid hitherto found on the potato. A few details are given of the external characters of *Ceronema africana,* Scott Maclie. Notes on *Lachnodius greeni,* Vayss., *Diaspis senegalensis,* Vayss., *Aspidiotus (Hemiberlesia) provincialis,* Vayss., and *Mytilaspis (Coccomytilus) dispar,* Vayss. are also given [see this *Review,* Ser. A, ii, p. 425].

Chatanay (J.). **Un Tenthrédinidé parasite des Renonculacées horticoles: *Holcocneme coeruleocarpa,* Hartg.** [A Tenthredinid parasite of garden Ranunculaceae: *Holcocneme coeruleocarpa.*]—*Ann. Service des Epiphyties, Paris,* ii (1913), 1915, pp. 311-320. [Received 11th May 1916.]

In May 1913 the leaves of *Aquilegia vulgaris* in the author's garden were attacked by larvae of the sawfly, *Holcocneme coeruleocarpa.* At first the injury was insignificant, but a few weeks later the insects appeared in neighbouring gardens, and also attacked other Ranunculaceae, particularly peonies and *Delphinium.* The adaptation of the species to Ranunculaceae is remarkable, as it usually occurs on Salicaceae, such as poplars and aspens. A description of the insect and of its habits is given. To control it, a solution of pyrethrum proved successful. To make this, one part by weight of pyrethrum powder was steeped in 20 parts of water for a night. The infusion was then filtered and diluted with 10 times its bulk of water. The spray was applied with a hand-sprayer.

Picard (F.). **Le *Cleonus mendicus* et le *Lixus scabricollis,* Curculionides nuisibles à la Betterave.** [*Conorrhynchus mendicus* and *Lixus scabricollis,* weevils injurious to Beet.]—*Ann. Service des Epiphyties, Paris,* ii (1913), 1915, pp. 321-340, 4 figs. [Received 11th May 1916.]

This paper is an extension of one which has already been abstracted [see this *Review,* Ser. A, ii, p. 89]. Of the several fungi infesting

Conorrhynchus (*Cleonus*) *mendicus*, only *Beauveria globulifera* occurs on this insect in the beet-fields of the Hérault, where the author has noticed it only on the subterranean nymphs, though, according to Danysz and Wize, the adults alone are subject to the attack of this fungus. The author found it easy to infect adults, larvae and nymphs by inoculation with the conidia. Death was also easily caused by simply projecting the spores on the integument, though in this case it was necessary to keep the insect in a slightly damp atmosphere. *B. globulifera* may therefore be tried as successfully as *Entomophthora anisopliae*, both species being capable of infesting the subterranean stages. Attempts to control the larvae with carbon bisulphide are not recommended, as the clay soil in which beets grow in the Hérault, is unfavourable to fumigation. Control should be directed against the adult, and mechanical methods, though more costly than insecticides, seem the more efficient. Hibernating adults may be killed by harrowing in winter to a depth of about 8 inches, so as to expose them to the weather. Collection in spring is still more important, and trained men should go carefully over the ground, turning up clods in order to secure the beetles sheltering beneath them. This must be repeated until the beets are large enough to protect themselves from attack.

MASI (L.). **Calcididi del Giglio, Prima serie. Materiali per una Fauna dell' Arcipelago Toscano, XI.** [Materials for a fauna of the Tuscan Archipelago.]—*Annali del Museo Civico di Storia Naturale di Genova, Genoa*, Serie 3., Vol VII (XLVII), 17th February 1916, pp. 1-66, 14 figs., 1 plate. [Received 10th May 1916.]

This, the first instalment of a paper on the Chalcid fauna of the Island of Giglio, deals with the TORYMINAE, LEUCOSPIDINAE, CHALCIDINAE, and part of the EURYTOMINAE. Records of 46 species are given, in most cases with valuable notes on the synonymy, morphology, host relation, parasitic status, etc. Three new genera are erected: *Idarnotorymus*, *Didactyliocerus*, *Belaspidia*, and seven new species. There is a full discussion under *Chalcis intermedia*, Nees, of the species (referred to as *C. flavipes*, Panz., by Howard and Fiske, U.S. Dept. of Agric., Bur. of Ent., Bull. No. 91) introduced into the United States to control *Lymantria* (*Porthetria*) *dispar*, of which it is a primary parasite. It also attacks *Zygaena filipendulae* and *Z. transsylvanica*. *Chalcis fonscolombei*, Duf., is a parasite of *Sarcophaga*, *Lucilia* and *Musca* and has also been reared at Portici from *Hyponomeuta malinellus*, being probably in this case a hyperparasite through some Dipteron.

DE STEFANI (T.). **L'*Aspidiotus hederae* sugli olivi in Sicilia.** [*Aspidiotus hederae* on olives in Sicily.]—*Minerva Agraria, Milan*, viii. (ii of series ii), nos. 7-8, 15th-30th April 1916, pp. 92-93. [Abstract from *La Viticoltura Moderna*, no. 6-7, January 1916.]

The few olives growing in a vineyard near Palermo, which were slightly infested with *Aspidiotus hederae* in 1914, have now become very seriously attacked. Properly timed applications of lime-sulphur should be effective against this pest. In Sicily, *A. hederae* is common on vines, but very rare on olives.

FULMEK (L.). **Zygopterenaier (Odonata) in Birnzweigen.** [Dragonfly eggs in pear twigs.]—*Centralbl. Bakt., Parasit. u. Infektionskrankheiten, IIte Abt., Jena,* xliv, no. 24-25, 12th January 1916, pp. 702-707, 14 figs. [Received 19th May 1916.]

In April 1915 the Plant Protection Station in Vienna received from South Tyrol a number of pear twigs, the green bark of which was covered with swellings on both sides of a wound caused by the oviposition of an insect, which was found to be a dragonfly belonging to the sub-family AGRIONINAE. The economic importance of the injury was not ascertained, as the eggs only were observed in the bark. As the further development of these insects takes place in the water, later damage to the twigs is not probable, though indirect injury, such as fungus attack, may arise.

De Spruitvreter of Knopworm der Bessenstruiken (*Incurvaria capitella*, **Fabr.** [The shoot-eater or budworm of currant bushes (*Incurvaria capitella,* Fabr.).]—*Med. Phytopath. Dienst., Wageningen,* no. 1, March 1916, 14 pp., 2 plates, 1 map.

This bulletin embodies the information contained in a paper already abstracted [see this *Review*, Ser. A, iv, pp. 89]. Maps are attached showing the extent of currant cultivation in Holland and the distribution of this pest.

De "Roode Worm" der Frambozen (*Lampronia rubiella*, **Bjerk.**). [The "Red worm" of raspberries, *Incurvaria* (*Lampronia*) *rubiella*, Bjerk].—*Med. Phytopath. Dienst., Wageningen,* no. 2, March 1916, 14 pp., 2 plates, 1 map.

This bulletin is also based on a former paper [see this *Review*, Ser. A, iii, p. 643] and is arranged on the same plan as the above with a similar map.

BATTAIL (J.). **Des Causes qui influent sur la Nocivité des Arsenicaux employés en Agriculture.** [On the causes which affect the toxicity of arsenicals employed in Agriculture.]—*Progrès Agric. Vitic., Montpellier,* lxv, (33rd year), no. 19, 7th May 1916, pp. 448–452.

The insecticidal value of the arsenical salts in general use in agriculture is stated to be proportional to the amount of arsenic they contain. The arsenates may be arranged in descending order as follows:—Lime, 37·9 per cent.; lead, 16·7 per cent. (lead arsenate stands out of place in the list because the metal itself is poisonous); sodium, anhydrous, 36 per cent.; arsenite of copper, 34·5 per cent., and the arsenates of iron and copper, 33·6 per cent. and 32 per cent. respectively. The order of toxicity is however modified by the varying degree of solubility and the presence of other salts produced in the process of manufacture which act as impurities; chlorides in any considerable quantity are stated to render the use of these arsenicals dangerous as they greatly increase the liability to scorching. Sodium arsenate is the only one soluble in water; its action is of short duration and at any strength exceeding 1 per 1,000 it may cause serious scorching: it is therefore only used as a basis for the preparation of the

others and as an excessive amount of chlorides is often present as an impurity and these render its employment dangerous, it is very necessary to insist on their absence when ordering this substance. The anhydrous form is very hygroscopic and unless kept in hermetically sealed vessels, it takes up water to an unknown extent, rendering it impossible, without analysis, to prepare a solution of given strength; details are given of a method of titration with standardised lime-water, using phenolphthaleine as an indicator. The calcium arsenate of commerce generally contains a considerable proportion of impurity, especially the sodium hydrate produced in the reaction, which, if not removed by decantation, reduces the toxicity by 38 per cent. Calcium arsenate properly prepared and free from chlorides, is said to have no caustic effect on plants and, other things being equal, is superior to lead and other arsenates as an insecticide; the most useful proportions for its preparation are five parts by weight of anhydrous sodium arsenate and two parts of fresh unslaked quick lime, the supernatant liquid being carefully decanted; the gross product of the reaction contains 23·5 per cent. of arsenic. Arsenate of lead is more difficult and more expensive to prepare and is obtained by adding three parts of neutral acetate of lead (sugar of lead) to one part of sodium arsenate; the acetate of soda produced in the reaction constitutes an impurity and the arsenical content is 10 per cent. of the salt present. Arsenite of soda is usually prepared by boiling together for an hour two parts by weight of white arsenic of commerce and four parts of carbonate of soda, or, if the commercial trisodic arsenite be used, 96 parts of it by weight mixed with 187 parts of sulphate of copper will yield 109 parts of copper arsenite (Scheele's green); the gross product of the reaction contains 17·4 per cent. of arsenic. Arsenate of iron is obtained by mixing in solution one part of arsenate of soda by weight with two parts of sulphate of iron, the gross product containing 17·2 per cent. of arsenic. Arsenate of copper is prepared by mixing in solution 104 parts by weight of sodic arsenate with 187 parts of copper sulphate, the gross product containing 16·9 per cent. of arsenic.

The unpurified arsenate of lime therefore contains a larger proportion of arsenic than any of the other compounds in the same state and it is stated that over and above this, the activity of arsenate of lime is 6·4 per cent. greater. The necessity for adhering strictly to the proportions given so as to have no excess of any reagents and the importance of decanting the supernatant liquid to get rid of bye-products which are not only useless but reduce the energy of the insecticide is insisted upon. The addition of these arsenicals to Bordeaux mixture with the idea of producing a combination spray against both insects and mildew reduces the effectiveness of the arsenical portion by 50 per cent., and it is a matter of common complaint that these mixed sprays are not effective. The presence of large quantities of chlorides in the water or the materials used greatly increases the risk of scorching. The sodic arsenate often contains considerable quantities, and in Algeria, water containing eight parts of chlorides in a 1,000 is of common occurrence and even three parts in 1,000 is objectionable; river water is the best, but even with this, great care must be exercised in dry weather when the streams are low and the percentage of chlorides greatly increased.

Feytaud (J.). **Instruction sommaire pour la défense contre la Cochylis et l'Eudémis.** [Brief instructions for the control of *Clysia ambiguella* and *Polychrosis botrana*.]—*Rev. Viticulture, Paris*, xliv, no. 1141, 11th May 1916, pp. 350–353.

This paper gives in a condensed form the usual instructions for the control of *Clysia ambiguella* and *Polychrosis botrana*. Insecticide formulae are given with a table of the months in which spraying should be carried out; methods of trapping are also described.

Los gases asfixiantes en la destrucción de la langosta. [Asphyxiating gases for the destruction of locusts.]—*Gaceta Rural, Buenos Aires*, ix. no. 105, April 1916, p. 543.

Experiments made in Argentina show that locusts die almost instantly in a space saturated with free chlorine; 2 per cent. of chlorine, acting for 30 minutes, causes death within twenty-four hours. With 1 per cent. of chlorine or less the results were unsatisfactory.

Elenco dei Comuni fillosserati o sospetti d'infezione fillosserica al 31 Dicembre 1915. [A list of communes infested by Phylloxera or suspected of being so infested on the 31st December 1915.]—*La Campagna, Como*, xvi, no. 249, 15th May 1916, pp. 134–135.

An alphabetical list is given of communes known to be infested with *Phylloxera* in Como, Lecco and Varese. Lists of the communes where the presence of this pest is suspected are also given.

Feytaud (J.). **Recherches sur les pièges-appâts: I. Les Appâts empoisonnés.** [Investigations on bait-traps: I. Poisoned baits.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, no. 5, May 1916, pp. 33–38.

This paper describes further experiments with bait-traps against *Clysia ambiguella* and *Polychrosis botrana* [see this *Review*, Ser. A, ii, p. 359], for the purpose of preventing the escape of the moths after capture. A modification of the shape of the containers was deemed inadvisable on account of the cost and because difficulty in exit would mean difficulty in entrance. A change in the composition of the bait-liquid was resorted to. A series of 52 pots were baited with the usual solution of fermenting molasses, three parts per thousand of sodium arsenite being added to the solution in each alternate pot. It was found that over 50 per cent. more adults of *P. botrana* were taken in the 26 poisoned pots than in the 26 unpoisoned ones, while examples of *C. ambiguella* were also more numerous. Chrysopid enemies of the vine-moths were also taken in larger numbers, so that with poisoned baits even greater care than usual is required in limiting the trapping period.

Cushman (R. A.) & Isely (D.). **The Cherry Leaf-Beetle, a Periodically Important Enemy of Cherries.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 352, 5th May 1916, 26 pp., 9 figs., 4 plates, 7 tables.

Another account of the Chrysomelid, *Galerucella cavicollis*, Lec. (cherry leaf-beetle) has recently been published [see this *Review*, Ser. A,

iv, p. 173]. Economic injury by this beetle was first recorded in 1894 by Davis, who found it feeding on cultivated cherry in Michigan. The 1915 outbreak was probably the most injurious that has ever occurred and advantage was taken of it to secure as complete data as possible in regard to the natural food-plants of the beetle, its life-history and the means for its control. The increased numbers of *G. cavicollis* may be attributed to an increase in abundance of its natural food-plant *Prunus pennsylvanica* (pin-, fir-, or bird-cherry). This tree springs up rapidly along road-sides and in partially cleared or fire-swept forest land which has been left uncultivated. Such lands cover wide areas in western Pennsylvania and furnish ideal breeding conditions for the beetle. The adult feeds almost exclusively on the underside of the leaves of the plants attacked. It also feeds on the fruit of the cherry. Occasionally the beetles have been observed feeding on the upper surface of peach leaves and once on the upper surface of cherry leaves. The preference for sickly or injured trees was marked. Such trees are invariably loaded with beetles, while the surrounding trees may be comparatively free from attack. The foliage on an unhealthy branch was attacked before the rest of the tree. The preference for the foliage on the lower limbs to that on the upper was still more marked, for the former may be completely defoliated while the latter are comparatively uninjured. The period of economic injury extended over 14 or 18 days after its first appearance in June, the greater part of the feeding being probably done during the first three or four days. There was no injury noticeable from the later brood. Severe injury was almost entirely confined to the Early Richmond cherry, especially to young trees. All the stages of *G. cavicollis* are described. After an average feeding period of about 12 days, the larvae entered the ground, remaining there for an average period of 22 days, of which the pupal stage occupied about 11 days. The emergence of the adults took place from a day to several days after transformation. The total developmental period lasted from 45 to 50 days. In captivity the sexes appeared in almost equal numbers. The earliest adult appeared on 23rd August, though beetles were observed somewhat earlier in the open. In the leaf-mould at the base of wild cherry trees, in which *G. cavicollis* were transforming in large numbers, small Carabid beetles were found, which have been determined as a large form of *Lebia ornata*, Say. In confinement these Carabids readily attacked the pupae and freshly emerged adults of *G. cavicollis*. In the course of a number of control experiments, arsenate of lead, not less than 5 lb. to 50 U.S. gals. of water, was effective in protecting trees from injury. An addition of 1½ U.S. gals. of molasses produced a more effective mixture that killed practically all the beetles on the trees to which it was applied, but this addition of sweetening matter had the serious disadvantage of rendering the spray readily removable by rain. Forty per cent. nicotine sulphate with water at the rate of 1 to 600, and with or without soap, was effective as a contact-spray. Weaker solutions of nicotine sulphate and soap-carbolic acid solutions, though apparently effective at the time of application, did not have a permanent effect. More extensive spraying experiments are required. As the larvae feed on a wild plant where control measures cannot be applied, the clearing up of cut-over woodland and its destruction would greatly diminish the damage done. The underside of the leaves must be covered by the spray.

and in large orchards into which the beetles are migrating in large numbers, it is advisable to begin by spraying the trees most susceptible to attack, since, during the season of 1915, the maximum injury occurred immediately after the first arrival of the beetles. In no case should the sweetened arsenate of lead be used with Bordeaux mixture as a combination spray, or scorching of the foliage is likely to result. A bibliography of 25 works is appended to this paper.

FROGGATT (W. W.). **The Rutherglen Bug** (*Nysius vinitor*, **Berg.**).—*Agric. Gaz. N.S.W., Sydney*, xxvii, no. 4, April 1916, pp. 270–272, 1 plate.

After having been comparatively harmless except in restricted areas for some years, *Nysius vinitor*, Berg. (Rutherglen bug) has been one of the most serious insect pests in New South Wales during 1915–16, being common also in South Australia and Victoria where similar damage over very large areas was done. *N. vinitor* was first recorded in the vineyards at Rutherglen in 1888. It is closely allied to *Blissus leucopterus* (chinch bug) and is among the worst of the native insect pests of New South Wales. When the bugs attack potatoes, tomatoes, etc., their presence is soon known by the drooping of the leaves and by the final destruction of the foliage or ripening seeds. In the orchard they damage fruit in all stages of development. The eggs of these bugs are generally found upon the stems of grass and weeds, or among rubbish on the ground, in which the young larvae also shelter. They can then be easily destroyed by burning off the weeds or spraying the infested areas with red oil emulsion. When, however, the bugs have entered orchards or gardens, control is more difficult. Where only a small area is infested, the bugs can be driven away by lighting a smudge fire to the windward of the trees, but this may have to be repeated several times, and it will only move them on. Catching the bugs is a better method, and in the early morning, while they are semi-torpid, they should be jarred into a pan of water and kerosene. A 9-foot sheet of galvanised iron can be converted into a shallow pan by turning up the ends and sides. This should be filled with a gallon of water to which a pint of kerosene is added. The thin scum of oil kills every bug as it drops in. A sheet may be used instead of a pan, but has to be rolled up and dipped in kerosene or boiling water to kill the bugs. Unsatisfactory results were obtained with light traps. An acetylene lamp with reflectors or an electric light might attract the bugs, but the cost would be very high. The present high price of benzole precludes its use in any quantity as a contact spray. Other contact poisons, such as kerosene, blue oil emulsion, or tobacco and soap, can often be effectively used, but spraying must be thorough and from the centre of the tree. Kerosene torches have been recommended and may be effective if carefully used.

ZIMMER (J. T.). **A Few Factors in Insect Control.**—*Philippine Agric. Rev., Manila*, viii, no. 3, 1915, pp. 169–175. [Received 25th April 1916.]

Insects may be divided into those which are beneficial, neutral, and injurious, though none of these groups are stable, since an insect may be injurious at one stage of its life-history and beneficial at another.

The blister beetles of America, for example, feed as larvae on locust eggs, while in the adult stage they attack lucerne and often cause serious injury. Destructive methods of control include natural enemies, trapping, collecting, exposure to extremes of temperature, inundation, and the application of poisons, corrosive mixtures or fumigants. Preventive measures include the application of dust sprays, formation of ditches, fertilisation of poor soils, cultivation of resistant stocks, use of screens, tarred bands, etc. Sporadic outbreaks are usually caused by a sudden decrease in the number of natural enemies. Absolute bird protection, unless it is proved that certain birds are more injurious than beneficial, is one of the best insecticidal methods. Too much reliance should not be placed on methods of controlling widespread pests by introduced parasites. When the prevalence of a pest is due to the change of conditions brought about by man, complete relief lies only in the re-establishment of the balance of nature.

PEROLD (A. I.). **Viticulture in South Africa.**—*Internat. Rev. Sci. & Pract. Agric., Rome,* vii, no. 1, January 1916, pp. 1-30, [Received 2nd May 1916.]

The principal insect pests of the vine in South Africa are *Phylloxera*, calanders [*sic*] and mealy bug. *Phylloxera* made its appearance at the Cape about 25 years ago, with the result that almost all the old vines are now extinct and nearly 90 per cent. of the present plants are grafted on American stocks. Nematodes cause considerable damage in very sandy soils, especially to European stocks. Calanders are most troublesome in young plantations where the soil has been recently trenched, especially in clay and peat soils. They cut the young leaves and shoots and later eat both berries and stalks of the green grapes; they generally disappear when the grapes begin to ripen, probably owing to the excessive heat. The simplest way of getting rid of these insects is to remove the soil around the vine so as to make a little hollow at the root at the beginning of the rainy season; when this is done, they disappear in about two years. Spraying with lead arsenate in spring and summer is also effective. Mealy bug (*Pseudococcus*) does a good deal of damage to trellised vines in the Cape Peninsula and the surrounding country. Cyanide fumigation is the best remedy, though costly.

SEITNER (—.). ***Bombyx pini* injurious to Pine Trees in Austria.**—*Internat. Rev. Sci. & Pract. Agric., Rome,* vii, no. 1, January 1916, pp. 173-175. [Abstract from *Centralblatt für das gesamte Forstwesen, Vienna,* xli, nos. 5-6, 1915, pp. 161-173.] [Received 2nd May 1916.]

The extensive damage caused in 1913 by *Dendrolimus* (*Bombyx*) *pini* to a forest near Vienna has afforded the author an opportunity of describing the life-history of this insect. The forest consists principally of black pine, which is felled every 80 years and replaced by new plantations. It also contains oaks, hornbeams and elms, and is surrounded by large cultivated fields. In November 1912, a great number of old cocoons were found in the bark of the pines and in the hedges, and later large numbers of small winter caterpillars were collected. Black pine, owing to the rough character of its bark, appears to be more favoured than white pine by the hibernating

caterpillars. To prevent the caterpillars from reaching the crown, a band of cloth, soaked in an adhesive, was placed round the trunk of the trees, at a cost of 13*s*. 6*d*. par acre. This measure was successful and large numbers were found to have been trapped by this means in the following spring. Examination of the trees showed that the caterpillars had been unable to pass the bands and the crowns were undamaged. The collected caterpillars were found to be attacked by parasites to the extent of 90 per cent., on account of which no preventive measures were taken in 1914. This experiment was successful and in that year the forest was little attacked, and still less so in the summer of 1915.

Parasites of the winter caterpillars were less numerous than those of the summer ones; they included the larvae of a Braconid, probably *Rhogas esenbeckii*, Hart., *Exochilum giganteum*, Grav., an Ophionid not yet identified and *Apanteles fulvipes*, Reinh., which is of little importance, but no Tachinid larvae were found on them. From several hundreds of these caterpillars reared entirely in captivity, 11 specimens of *Sturmia* (*Zygobothria*) *bimaculata*, Htg., which hatched in May, and a single specimen of *Pales pavida*, Mg. (*P. cilipeda*, Rnd.) were obtained. Of 1,598 examples of adult caterpillars and pupae collected at the end of June and beginning of July, 3 per cent. were parasitised by Ichneumonids and 76·6 per cent. by Tachinids and Sarcophagids. The TACHINIDAE were almost exclusively represented by *Blepharopoda scutellata*, R. D., and the SARCOPHAGIDAE by *Sarcophaga affinis*, Zell., *S. atropos*, Mg. and *S. carnaria albiceps*. The ICHNEUMONIDAE were mostly represented by *Exochilum giganteum*, Grav., *Theronia atalantae*, Krieg., and *Pimpla instigator*, and the Chalcid, *Monodontomerus dentipes*, Dalm. The principal parasite of the eggs was *Teleas laeviusculus*, which appears to have been very useful.

It is stated in conclusion that the few caterpillars which remain during the winter in the crown of the pine trees do not diminish the practical value of employing adhesive belts. In order to localise the most infested places it is necessary to collect the larvae from a certain number of trees in each zone during the winter. In the forest under consideration, the most important enemies were *Blepharopoda scutellata* and the SARCOPHAGIDAE. The bed of pine-needles should not be removed, as it affords good cover for the natural enemies, especially those of the winter caterpillars, though the most important parasites are those which attack the summer caterpillars and the pupae.

JABLONOWSKI (J.). *Phlyctaenodes sticticalis*, **Microlepidoptera Injurious to Plants cultivated in Hungary.**—*Internat. Rev. Sci. & Pract. Agric., Rome*, vii, no. 1, January 1916, pp. 172–173. [Abstract from *Kozlelek, Budapest*, xxv, no. 32, 1915, pp. 1157–1160.] [Received 2nd May 1916.]

In July 1915, reports were sent to the Royal Hungarian Entomological Station that in Transylvania an unknown larva was causing serious and unexpected havoc. It attacked in swarms the fields of lucerne, clover, horse beans, maize, pumpkins, potatoes and peas. In one place it completely destroyed whole fields of lucerne and clover. The insect in question proved to be *Phlyctaenodes sticticalis*, L., which

had appeared previously in Hungary in 1901. Since then it had not been seen again, except in 1905 in one place near Pest. This insect comes from Russia where it has caused considerable havoc at different times ever since 1769. It is also known in the United States, where it was probably introduced from Russia. In America and also more recently in Russia, it has shown a marked preference for sugar-beet. The author was unable to ascertain whether this moth has lived on weeds without attracting the notice of farmers during the fourteen years since the last outbreak, or whether the present invasion was derived from the swarms which occurred in Russia during 1909, 1912 and 1913. The life-history of the insect is described with the measures of control adopted in Russia and in America. In Hungary only one generation of *P. sticticalis*, namely the July one, has hitherto caused damage. The following generation disappeared, leaving no trace, and no serious attention was therefore given to prevent a further spread of the insect. Nevertheless the following means of control are advised: Surrounding the infested fields with a ditch and destroying the larvae along it; spraying the unattacked portions of infested crops with a 3 to 5 per cent. solution of barium chloride and ploughing the soil deeply in the infested places, accompanied by a thorough extermination of all weeds.

RIVEROS (E.). *Chilocorus 4-pustulatus*, **a Natural Enemy of** *Aphis persicae* **and perhaps also of** *Eriosoma lanigera*, **in Argentina.**—*Internat. Rev. Sci. & Pract. Agric., Rome*, vii, no. 1, January 1916, p. 172. [Abstract from *La Enologia Argentina, Mendoza*, Year 1, no. 6, pp. 163–164, 1915.] [Received 2nd May 1916.]

When visiting the Agricultural School of San Juan in February 1915, the author noticed numerous examples of *Chilocorus 4-pustulatus* on peach-trees which had been attacked by *Aphis persicae*, but on which all traces of that Aphid had disappeared. Examples of the same Coccinellid were also stated to have been seen on apple trees attacked by *Eriosoma lanigerum*.

SANZIN (R.). **The "White Cochineal of the Vine"** (*Pseudococcus vitis*) **in the Provinces of Mendoza and La Rioja (Argentina).**—*Internat. Rev. Sci. & Pract. Agric., Rome*, vii, no. 1, January 1916, p. 173. [Abstract from *La Enologia Argentina, Mendoza*, Year 1, no. 6, pp. 164–165, 1915.] [Received 2nd May 1916.]

The presence of *Pseudococcus vitis* has been noticed for some time past at Mendoza, and this pest is menacing the cultivation of vines recently started in that province. While this scale has two generations in the year in Europe, in these regions, owing to the warm climate, it may have three or more. The individuals of the last generation hibernate under the bark of the stocks, hence the necessity of removing the bark from the vines in autumn so as to destroy the largest possible number of individuals. The plants are then treated with lime-sulphur wash or petroleum emulsion.

YOUNG (H. D.). **The Generation of Hydrocyanic Acid Gas in Fumigation by portable machines.**—*California University Agric. Coll., Berkeley*, Circ. 139 (N.D.), 8 pp., 5 figs. [Received 8th May 1916.]

The tents used for fumigation with hydrocyanic acid suffer considerable damage from burns by acid when the ordinary pot method of generating the gas is employed, and therefore a portable generator from which the gas may be delivered to the tent from the outside is a distinct advantage, not only as preventing the damage to the tents, but also as an economiser of material and giving better control. The portable fumigating machine here described consists of a cylindrical drum around the inner, upper part of which is a circular tank for cyanide solution connected on one side with a pump, the delivery tube of which projects into the centre of the drum. By operating this pump the cyanide solution may be delivered in measured quantities. The full charge is 600 oz. pure sodium cyanide dissolved in 150 U.S. gals. water placed in the upper tank and 600 oz. of concentrated sulphuric acid diluted with an equal volume of water placed in the bottom part of the drum; this is sufficient to generate the whole of the gas provided for by the cyanide. The pump is graduated in ounces of solid cyanide, as this is the usual basis of calculation for the fumigation. The method of mixture adopted, namely, of running a standard cyanide solution as required into fairly concentrated sulphuric acid, involves the steady dilution of the acid each time a charge is used. As this is contrary to the usual practice, a series of careful experiments was conducted in order to determine the efficiency of the generation; the results were perfectly satisfactory and showed that up to the last charge the amount of gas involved, though slightly less in proportion, was still quite efficient. Another objection was the solubility of the gas in the diluted acid; this, though serious in the cold, is of small amount if the liquid be warm; this warmth is obtained by mixing the acid and water just before use and jacketing the machine with some non-conductor to minimise the loss of heat. This method is found to be accurate in dosage, to give a rapid and uniform generation of gas and does not burn the tents. The apparatus must be kept scrupulously clean and no dirt must be allowed to enter the pump.

CONOR (M.). **Les invasions de sauterelles en Afrique Mineure. (Figurations et Textes anciens.)** [Locust invasions in North Africa. Ancient figures and text references.]—*Arch. Instit. Pasteur Tunis, Tunis*, ix, no. 3, 1st April 1916, pp. 149-156, 1 plate.

This paper contains a series of quotations from ancient writers from Herodotus to the Byzantine poet Corippus concerning locust invasions in Northern Africa and their effect. Reproductions of six figures of locusts from mosaics found at El-Djem are given. These are stated to be so accurate that there can be no doubt that the species concerned was *Schistocerca peregrina*.

BEESON (C. F. C.). **Ambrosia Beetles or Pin-Hole and Shot-Hole Borers. (Col., Fam. Ipidae, Platypodidae).**—*Indian Forester, Allahabad*, xlii, no. 4, April 1916, pp. 216-223, 1 plate.

Ambrosia beetles belonging to the PLATYPODINAE are abundant in India and Burma, while those of the SCOLYTINAE are represented in temperate forests. The majority live in the larval stages on a fungus

growing in galleries bored in the wood by the parent beetles. Certain species of ambrosia fungi are believed to be definitely associated with certain species of beetles. The spores of the fungus are distributed by the adults either accidentally or intentionally, as in the case of the European species *Xyleborus dispar*, F., where the spores are carried in the crop and later regurgitated, or as in some Indian forms, where the dorsal pores of the thorax serve as carriers. The trees attacked are those which have been weakened by other insects, fungi, etc., or have been recently felled. Healthy trees, and barked or partially seasoned unbarked logs are rarely attacked, while dry timber is immune. Direct fatal injury has been recorded in the case of living tea, coffee, camphor, pomaceous and citrus fruits, etc.

The galleries in the sapwood and outer heartwood are referable to three types. In the case of *X. major*, Steb., *X. semigranosus*, Bldfd., *X. fornicatus*, Eichh., and *Eccoptopterus sex-spinosus*, Motsch., the gallery consists of an entrance tunnel bored horizontally into the sapwood of the sal tree [*Shorea robusta*] ending in an irregular chamber from which a number of branches are given off. Pairing in *X. major* occurs before the migratory flight; eggs are laid in groups of from three to six in the innermost branches. Egg-laying and extension of the galleries continues as long as conditions are favourable. Pupation of the larvae takes place in the lateral branches or in the central chamber. A very large proportion of the adults are females. In *X. fallax*, Eichh., the entrance tunnel runs horizontally and radially into the sapwood, and from it the main tunnel passes right or left, following the rings of wood. Secondary branches given off from the main tunnel are occupied by eggs or larvae. Pupation usually takes place in special chambers on the main and lateral galleries or in the outer part of the sapwood. Modifications of this type are found in *X. perforans*, Woll., *X. andrewesi*, Bldfd., *X. parvulus*, Eichh., *X. submarginatus*, Bldfd. and *X. laticollis*, Bldfd. The galleries of the SCOLYTINAE differ in the presence of a special pupal chamber for each individual, formed on the primary or secondary tunnels. In the genus *Crossotarsus* the entrance gallery runs radially and horizontally to a depth of from 2 to 4 inches, then gives off a series of vertical branches, terminating in vertically arranged pupal chambers. Eggs, larvae and immature adults occur in all parts of the system.

The following is a list of ambrosia beetles attacking *Shorea robusta* :— SCOLYTINAE : *X. andrewesi*, Bldfd. ; *X. aplanatus*, Wich. ; *X. fallax*, Eichh. ; *X. laticollis*, Bldfd. ; *X. major*, Steb. ; *X. parvulus*, Eichh. ; *X. perforans*, Woll. ; *X. schlichii*, Steb. ; *X. semigranosus*, Bldfd. ; *X. submarginatus*, Bldfd. PLATYPODINAE : *Crossotarsus bonvouloiri*, Chap. ; *C. saundersi*, Chap. ; *Diapus furtivus*, Samps. ; *D. quinquespinatus*, Chap. ; *Platypus cavus*, Stroh. ; *P. cupulatus*, Chap. ; *P. curtus*, Chap. ; *P. solidus*, Chap. ; *P. pilifrons*, Chap.

MORRILL (A. W.). **Report of the Entomologist of the Arizona Commission of Agriculture and Horticulture.**—*Arizona Commiss. Agric. and Hortic., 7th Ann. Rept. for the Year ending 30th June 1915, Phoenix*, 24th December 1915, pp. 9–50, 18 figs., 6 plates. [Received 23rd May 1916.]

During the year ended 30th June 1915, the following insect pests were found on imported nursery stock or other plants :—*Coccus*

hesperidum (soft brown scale), *Aspidiotus camelliae* (greedy scale), *Saissetia oleae* (black scale), *Chrysomphalus aurantii* (California red scale), *C. aonidum* (Florida red scale), *Aulacaspis rosae* (rose scale), *Lepidosaphes beckii* (purple scale), *Hemichionaspis aspidistrae* (fern scale), *Pseudococcus citri* (citrus mealy bug), *Aleurodes* (*Dialeurodes*) *citri* (citrus whitefly), an undetermined whitefly and thrips, *Eriosoma lanigerum* (woolly apple aphis), *Aegeria exitiosa* (eastern peach borer), mulberry borer, and *Tetranychus telarius* (red spider).

Orchard inspection was mainly directed against the San José scale [*Aspidiotus perniciosus*] and the codling moth [*Cydia pomonella*]. In the inspection of citrus fruits during the autumn and winter of 1914–15 a normal amount of scarring by *Scirtothrips citri* (citrus thrips) was recorded, in addition to continued freedom from scale-insects. Measures were taken to prevent the introduction into the State of the lucerne weevil [*Hypera variabilis*]. Demonstrations were given on the control and eradication of the San José scale, *Parlatoria blanchardi* (date palm scale), codling moth, bryobia mite [*Bryobia pratensis*], grape flea-beetle, cabbage worm, melon louse [*Aphis gossypii*] and grasshoppers. Investigations on the control of the harvester ant [*Pogonomyrmex barbata*], the green June beetle [*Allorhina nitida*] and the alfalfa seed Chalcid [*Bruchophagus funebris*] were undertaken. *P. barbata* is now under complete control in the experimental lucerne field, but has not been exterminated. Failure to accomplish extermination may have been due to the fact that the field was not used either for pasture or cropping, thus allowing a rank growth of weeds and lucerne. The amount of London purple required was 2½ lb. as against 28½ lb. during 1914. The results of experiments against *B. funebris* indicated the value of border trap-crops as a means of control.

The flea-beetle, *Haltica foliacea*, which was unusually abundant and destructive to the foliage of apple and grape in 1914, was not recorded in 1915, but an allied form *H. carinata* (steel-blue grape flea-beetle) was present on deciduous fruit trees, grapes, and a native plant, *Pachylophus eximius* (desert primrose), growing in a vineyard in the Salt River Valley. This is probably the native food-plant and is widely distributed in Arizona at elevations below 3,500 or 4,000 feet. *P. eximius* is a well-known weed in vineyards in south California. In Arizona the beetles appeared during the last week in March and the first two weeks in April. Spraying with lead arsenate, at the rate of 1 oz. of powder to 1 U.S. gal. water, with 1 oz. soap in every 8 U.S. gals., proved an effective remedy. Clean culture appears to be important. *Bryobia pratensis* was injurious to orchard trees in one district. Spraying on 4th May with sulphur at the rate of 3 lb. to 50 U.S. gals. water gave practically no results, but a second application was effective. *Chrysobothris femorata* (flat-headed apple borer) was destructive to peach, apricot and plum trees in the Salt River Valley. This insect confines its attacks to weak or wounded trees and in the Salt River Valley it has been noted that over-cropping of fruit trees is liable to be followed by severe attack by the borer. The most severe damage is usually done to young trees, where one or two borers may girdle and kill the tree. Extensive damage is usually traceable to conditions which have been unfavourable to vigorous growth. The presence of borers can usually be detected by slight discolorations of the bark, by sawdust-like castings

and sometimes by the exudation of gum. Badly infested trees should be dug up and destroyed. When not abundant, the larvae may be dug out with a knife, but preventive measures are more important than the destruction of borers after infestation has occurred. The trunks may be protected by a wrapping made of several thicknesses of newspaper and the soil should be heaped up round the bottom of the paper covering to protect the base of the tree. Whitewash may also be applied to the exposed parts of the trunk and to the larger branches. The whitewash is prepared from 16 lb. stone lime with sufficient water to slake it, 5 lb. melted beef tallow and 5 lb. salt. The lime should not be allowed to boil. One application made in May will be sufficient for the season. Whale-oil or soft soap, formed into a thick liquid by adding a solution of caustic potash or washing soda, with 1 pt. crude carbolic acid to each 10 gals. of the wash, also acts as a deterrent. The first application should be made in May and the second and third at intervals of about six weeks. A species of *Leucotermes* was apparently responsible for the destruction of pear trees in two districts, and also of olives. The trees were completely severed just below the surface of the ground. *Frankliniella tritici* (wheat-flower thrips) was less destructive to deciduous fruits than usual. Blackberries were most seriously injured, attack resulting in the premature dropping or imperfect development of the fruit. Good results were claimed from the use of nicotine whale-oil soap mixture, used at the rate of one teaspoonful Black Leaf 40, ½ oz. soap, and one gal. water. Experiments on the grafting of English and French varieties of walnuts on native stocks led to the discovery of two boring pests of walnut, namely, *Prionus californicus* and *Euzophera aglaeella*. *P. californicus* is known to attack apple, blackberry, grape, oak, poplar, prune, black walnut and English walnut. The larvae work in the roots of both living and dead trees, as long as the wood of the latter is moist. Wounded bark or improper pruning may lead to decay and attack by this beetle, though it is not probable that injury in walnut orchards will ever be severe. The larvae can be controlled by destroying them in their burrows by means of a knife or a wire. The caterpillars of *E. aglaeella* burrow under the bark next to the sap wood and in some cases completely girdle the tree. The burrows are easily detected by the accumulation of frass at the opening. The best remedy is to cut out the larvae with a knife before 1st May. An allied species, *E. semifuneralis* (American plum borer), is widely distributed in the United States and Canada. Young olive trees were considerably damaged by *Cicada cinctifera*. Small stems and branches were weakened by the formation of egg punctures, so that it was found advisable to cut out affected parts as soon as the adults had disappeared. Hand-collection of adults in the early morning is recommended. *Scirtothrips citri* was less abundant than usual. There appears to be a definite relation between the amount of injury by thrips and the growth of vegetation between the rows of trees. Fruit from clean cultivated groves is usually more scarred than that produced in orchards in which weeds, lucerne, or grass may be present. The grasshopper, *Melanoplus differentialis*, was injurious to lucerne in some districts. Poisoned bait prepared according to the formula, 20 lb. wheat bran, 1 lb. Paris green, 2 U.S. qts. molasses, 3 oranges or lemons and water, was effective against insects which had passed the second nymphal stage. By doubling the number

of oranges or lemons and by increasing the amount of bran to 25 lb., the bait was made attractive to young hoppers. A modified Criddle mixture consisting of 50 lb. fresh horse manure, 1 lb. Paris green, 1 lb. salt, and three oranges is recommended for use against the young forms. The bait should be scattered on damp ground if possible. *Stictocephala festina* (three-cornered alfalfa hopper) was destructive to a lucerne seed crop near Phoenix. Injury is due to the feeding habits of both immature and adult forms, which suck the juices from the stems. The scars produced sometimes appear as rings or girdles with a gall formation, and the stem is liable to break off at this point. Clean cultivation is the only suitable control measure. The Erotylid beetle, *Languria mozardi* (alfalfa stem borer) was present in injurious numbers in the Salt River Valley in the summer of 1915. Coarse stems were more subject to infestation than the finer ones, and damage was greatest in fields which had not been well cultivated and irrigated. Sugar-cane was attacked by *Diatraea* sp., probably *lineolata* (Mexican moth borer), and by *Sphenophorus phoeniciensis* (bill bug). The last-named species was present in June and the beginning of July, attacking mainly the young canes. The point of injury was usually at, or near the junction of the new cane with the mother stalk. Pupation was observed to take place in the soil and probably began after 8th July. Damage was most serious in a plot which for several years previously had been left to grow Bermuda and Johnson grass. Maize was attacked to a marked degree by the cotton boll worm [*Chloridea obsoleta*], especially during August. In one field from 70 to 75 per cent. of the stalks were infested, but the yield was not appreciably reduced. The larvae over a small part of the field were destroyed by shaking a mixture of equal parts of lead arsenate and flowers of sulphur into the unfolding buds. This method of control should not be used in cases in which the stalks are required for fodder. Owing to the unusual winter conditions in 1914–15, the melon aphis [*Aphis gossypii*] was abundant on the weed, *Malva parviflora*, and later became prevalent throughout melon fields. Natural enemies were abundant and acted as effective checks. This fact suggests that it is more important to guard against Aphids in melon fields during seasons which are not favourable for continuous winter breeding than during those in which the insect is found in large numbers upon weeds before melons are planted. Three unidentified species of blister beetles were reported as attacking vegetable crops. Cutworms were abundant in southern Arizona. *Trichobaris trinotata* (potato-stalk weevil) increased in importance in the southern parts of the State. The native food-plant is the yellow-flowered ground cherry. The eggs are laid in punctures in the stalks of the host plant, and the larval and pupal stages are passed in the middle of the stem. There is probably more than one generation annually. The only practical measure of control is the destruction of weeds in which the insect may breed. The salt marsh caterpillar [*Estigmene acraea*] appeared as a pest of beans in one locality. The egg-masses can be collected by hand or a lead arsenate spray used against the larvae. The most destructive cotton pest was a Capsid bug allied to *Lygus pratensis*. Clean cultivation and autumn and winter ploughing are important in reducing the numbers of the insect. The cotton leaf caterpillar [*Anomis argillacea*] was generally distributed, but in smaller numbers than in preceding years. *Tetranychus bimaculatus*

(cotton red spider), occurring on strawberries and violets, has not yet been found on cotton in Arizona. If found in cotton fields, it is easily checked by spraying with potassium sulphide solution (3 lb. to 100 U.S. gals. water). Extensive defoliation of sage by the beetle, *Trirhabda canadensis*, occurred on the Navajo Indian Reserve. This species has also been observed on *Solidago canadensis* (golden rod) in New York, and an allied form, *T. luteocincta*, on *Artemisia californica* in California. The outbreak of *T. canadensis* is probably not of great significance and the insect will resume its normal status in a short time. If injurious numbers continue to be present, the use of natural enemies seems to be the only possible means of control.

Proclamation concerning the Black Weevil Borer of Bananas.—*Jamaica Gaz. Extraordinary*, 28th April 1916.

This Proclamation orders the destruction by fire or otherwise of banana and plantain plants or parts of plants infected by the black weevil borer [*Cosmopolites sordidus*]. No suckers may be planted on, or removed from land found to be infested with this weevil.

WATTS (Dr. F.). **On Legislating against Plant Diseases.**—*West Indian Bull., Barbados*, xv, no. 3, 1915, pp. 158–165. [Received 26th May 1916.]

Legislation against plant pests and diseases should be so framed that it will meet changing conditions, but at the same time should be sufficiently definite to afford communities the protection to which they are reasonably entitled. It is suggested that pests and diseases of plants should be divided into two classes, namely, those causing serious injury, and those which, though troublesome, cause less damage. Pests and diseases of the first group should be made notifiable and should be dealt with in schedules and regulations made under the Ordinance. Pests and diseases of the second class would become known through agricultural officers and cultivators of crops and legislation in this direction should consist of the appointment of inspectors to report on such pests and diseases. Neglect to control an infectious but non-notifiable disease on the recommendation of the inspector should, if necessary, be followed by a magisterial order to enforce control. Penalties should attach to any neglect to comply with the latter and power should be given to the Government, through its proper officers, to carry out the necessary measures at the owner's expense. To prevent the introduction of pests and diseases, imported plants should be inspected on arrival and dealt with as required by the inspectors. Provision should also be made to prohibit importation from countries in which any dangerous pest or disease is known to exist. This paper concludes with the draft of a bill framed on these principles to prevent the introduction and spread of plant pests and diseases.

HARLAND (S. C.). **Notes on** ***Trichogramma minutum (pretiosa).***—*West Indian Bull., Barbados*, xv, no. 3, 1915, pp. 168–175. [Received 26th May 1916.]

Experiments were carried out to observe the extent to which *Trichogramma minutum*, Riley, obtained from the eggs of *Diatraea saccharalis*, is capable of parasitising other insect eggs. To induce parasitism a number of eggs produced under insectary conditions, and therefore unparasitised, were exposed to the attacks of *T. minutum*. Oviposition took place readily in the eggs of *Chloridea* (*Heliothis*) *obsoleta*, F. (cotton boll worm), 16 parasites emerging from six eggs in nine days after oviposition. Under field conditions about 40 per cent. of the eggs of *C. obsoleta* were parasitised by *T. minutum*, by a Chalcid indistinguishable from *T. minutum* and by an unidentified Hymenopteron. In the case of *Laphygma frugiperda*, S. and A. (corn worm), oviposition by *T. minutum* was observed to take place in eggs from which the hairy covering was more or less absent. An average of three parasites per egg was obtained. Under certain conditions, therefore, *T. minutum* can parasitise the eggs of *L. frugiperda*, though in nature the protection afforded by the hairy covering renders the parasitism almost negligible. Egg-laying was also found to take place in the eggs of *Utethesia ornatrix* (pink underwing moth), *Eudamus proteus*, L. (bean leaf-roller), *Calpodes ethlius*, Cram. (arrowroot worm), and an unidentified cutworm. Parasites other than *T. minutum* were reared from the eggs of the above-mentioned insects collected in the field. Attempts to induce oviposition on the part of these parasites in eggs of another insect met with negative results. *T. minutum* was in every case a subsidiary parasite, since the number obtained in the field was always less than that of other egg-parasites of the same host.

Two methods are suggested for the control of *Diatraea saccharalis* :— (1) To breed *T. minutum* in captivity and liberate this species at intervals ; (2) to increase the number of hosts of *T. minutum*, preferably on the windward side of canefields. *Utethesia ornatrix*, which lays large clusters of eggs and feeds on the leguminous weed *Crotalaria*, should prove suitable for increasing the numbers of *T. minutum*. The practice of growing *Crotalaria retusa* in or near cane-fields should result in the control of *D. saccharalis* to a certain degree and also of *C. obsoleta* and the cotton worm [*Anomis argillacea*.] *M. ornatrix* however is also parasitised by a Hymenopteron, which is more abundant than *T. minutum* and hinders the oviposition of the latter, and by a Braconid, which attacks the larva, and reduces the number of moths available for egg-laying.

PAYNE (Olga G. M.). **On the Life-History and Structure of** *Telephorus lituratus*, **Fallen.**—*Jl. Zool. Research, London*, i, no. 1, April 1916, pp. 4–32, 18 figs., 2 plates.

Larvae of the Malacoderm beetle, *Telephorus lituratus*, Fall., were found near Manchester among and below the roots of grass at a depth of about 2 inches and near the roots of elder and rhododendron. The first larvae were obtained in October and other specimens at intervals until the following June. Pupae were observed on 12th May and the first adult on 1st June. Eggs were deposited on 25th June by adults

captured on the previous day, but failed to hatch. Some of the larvae collected were placed singly in breeding tins in a greenhouse, while others were kept in the open under conditions approaching the normal as nearly as possible. Experiments on the feeding habits of the larvae seemed to show that they are primarily carnivorous; the larvae of the Syrphid, *Platycheirus albimanus*, F., of a Noctuid, *Leucania* sp., and Dipterous larvae of the family BORBORIDAE are readily attacked, though some individuals were also fed on the grains of wheat. These were attacked at the germinating end, and in some cases the young shoots were also eaten. Maize, barley and oats were rarely attacked. Potatoes, turnips, carrots, etc., in the soil are probably only attacked when already damaged. When both wheat grains and the larvae of *Leucania* and *P. albimanus* were present, the former only were attacked, and it may be assumed that in the absence of animal food serious damage may be done to cereals or vegetables. The larvae are attacked by the Carabid beetle, *Pterostichus madidus*. Owing to their hairy covering they are able to survive in water for a long time; they can also exist for about two days in the total absence of moisture. Pupation occurs in circular burrows at a depth of from 2 to 3 inches; in captivity the first pupa was observed at the end of March. Pupae were found difficult to bring to the adult condition, owing to their susceptibility to increase in temperature and to the readiness with which they were attacked by a fungus. The presence of a clay soil was found to be important. Adults occur in nature on nettles, grass and trees near the larval habitat. Egg-laying takes place in June and July, and the adult stage probably does not last more than six weeks; the adult is probably omnivorous. Allied species are known to attack Aphids and the eggs of *Icerya*, while *T. bilineatus* feeds on the young leaves of birch. The anatomy of the larva and the external characters of pupa and adult are described.

GREEN (E. E.). **Observations on some recently described Coccidae.**—*Bull. Entom. Research, London*, vii, no. 1, May 1916, pp. 51-52, 1 fig.

Pseudococcus bicaudatus, Keuch. [see this *Review*, Ser. A, iii, p. 647] is stated to be a synonym of *P. virgatus*, Ckll., other synonyms of this species being *P. ceriferus*, Newst., *P. talini*, Green, and *P. marchali*, Vayssière. *Fiorinia morrisi*, Brittin [see this *Review*, Ser. A, iii, p. 721] is stated to be identical with *F. asteliae*, a synonym of *F. gigas*, Mask., now placed in the genus *Leucaspis*. *Pinnaspis nitidus*, Britt., is a synonym of *Lepidosaphes* (*Mytilaspis*) *pyriformis*, Mask., *Lecanium armatum*, Brit., of *Ctenochiton spinosus*, Mask., and *Cryptococcus nudatus*, Brit., of *Kuwanina* (*Sphaerococcus*) *parvus*, Mask. *Fiorinia maskelli*, Brit., should be referred to the genus *Leucaspis*, and *Sculare fimbriata*, Brit., to *Rhizococcus*.

GREEN (E. E.). **Remarks on Coccidae from Northern Australia—ii.**—*Bull. Entom. Research, London*, vii, no. 1, May 1916, pp. 53-65, 11 figs.

The following scale-insects are recorded:—*Aspidiotus destructor*, Sign., on foliage of *Pandanus odoratissimus*; *A. fodiens*, Mask., on *Melaleuca leucadendron* and *Pithecolobium moniliferum*; *A. orientalis*,

Newst., on *Ficus orbicularis*, on milkwood tree and on an undetermined introduced tree; *A. unilobis*, Mask., on *M. leucadendron*; *A.* (*Aonidiella*) *miniatae*, sp. n., on twigs of *Eucalyptus miniata*; *A.* (*Aonidiella*) *subcuticularis*, sp. n., on the leaves of *Ficus orbicularis*; *Porogymnaspis rufa*, gen. et sp. n., on leaves of *P. odoratissimus*; *P. angulata*, gen. et sp. n., on *P. odoratissimus*; *Chionaspis dilatata*, Green, on *P. odoratissimus*; *C. graminis*, Green, var. near *divergens*, on grasses; *Hemichionaspis minor*, Mask., on *Grevillea heliosperma* and sisal hemp; *H. pseudaspidistrae*, sp. n., on *P. odoratissimus*; *Lepidosaphes incisor*, sp. n., on *M. leucadendron*; *L. hemichionaspiformis*, sp. n., on *M. leucadendron* and heavily attacked by a red parasitic fungus; *Leucaspis japonica* var. *darwiniensis*, var. n., on foliage of *Ficus orbicularis*; *Fiorinia acaciae*, Mask., on *Acacia* sp.; *Saissetia* (*Lecanium*) *nigra*, Nietn.; *Pulvinaria psidii*, Mask.; *Asterolecanium hilli*, sp. n., on foliage of the palm, *Livistona humilis*; *Sphaerococcus diaspidiformis*, sp. n., on leaf-stalks of *L. humilis*.

CAMERON (A. E.). **Some Experiments on the Breeding of the Mangold Fly** (*Pegomyia hyoscyami*, **Panz.**) **and the Dock Fly** (*Pegomyia bicolor*, **Wied.**)—*Bull. Entom. Research*, *London*, vii, no. 1, May 1916, pp. 87–92, 2 figs.

The food-plants of *Pegomyia hyoscyami*, Panz., belong mainly to the families CHENOPODIACEAE and SOLANACEAE, although the CARYOPHYLLACEAE and COMPOSITAE may also be attacked. The dock is not a host plant of *P. hyoscyami*, but of an allied species, *P. bicolor*, Wied. The leaves of dock are also mined by *P. nigritarsis*, Zett. Experiments carried out in 1912 and 1913 to ascertain whether adults of *P. hyoscyami*, reared from larvae fed on belladonna leaves, would oviposit on leaves of mangolds met with negative results. [See this *Review*, Ser. A, ii, pp. 616–618.] The experiments were repeated in 1915 on a larger scale. Sugar-beets were sown in some compartments and mangolds in others; the plants were kept free from weeds throughout the summer. In the first compartment, in which sugar-beets were sown, *P. bicolor* reared from *Rumex obtusifolius* was liberated; in the second and third, both sown with sugar-beet, were liberated *P. hyoscyami* reared on belladonna and on mangolds respectively. In the last two compartments, sown with mangolds, were placed *P. bicolor* reared from dock and *P. hyoscyami* from belladonna. The insects were introduced between 22nd June and 3rd September. Oviposition was first observed on 9th August, on the part of females in the last cage. By 3rd September the leaves were badly blistered by the larvae. The following conclusions were reached as the result of these experiments:—(1) *P. hyoscyami* reared on belladonna will oviposit and complete its life-history on mangolds if belladonna is absent. (2) *P. hyoscyami* reared on mangolds did not oviposit on sugar-beet. (3) *P. bicolor* reared on dock did not oviposit and complete its life-history on mangold or sugar-beet. It may be assumed that *P. hyoscyami* reared on mangold or sugar-beet will not oviposit on dock. (4) A careful examination of blistered leaves of weeds and cultivated plants must be made before asserting that damage is due to either of the above species. *Chenopodium album* (goosefoot) is definitely known to be attacked by *P. hyoscyami*, but the occurrence of a migration from this plant to mangolds has not yet been established.

PANTEL (J.). **Note biologique sur *Rhacodineura antiqua*, Fall. (et non *Ceromasia rufipes*, B. B.), Tachinaire parasite des Forficules.** [Biological note on *Rhacodineura antiqua*, Fall. (nec *Ceromasia rufipes*, B. B.), a Tachinid parasite of earwigs.]—*Bull. Soc. Entom. France, Paris*, no. 8, 1916, pp. 150–154.

In some previous papers on the habits of *Rhacodineura antiqua*, Fall., the author had incorrectly recorded this species under the name, *Ceromasia rufipes*, B.B. *R. antiqua* was first described by Rodzianko from south Russia, where it was observed to live singly in young forms of *Forficula tomis*, Kolenati. Adults were found on the wing in the summer and pass the autumn and winter in the larval stage in the body of the host. There is one egg-laying period, though the eggs are deposited in several hosts. The first stage larva, which has not been observed, is assumed to be temporarily present in some protected and well aerated position in the host. In the second stage the larva lies freely in the body cavity, and towards the end of this stage it migrates to the region of the neck and bores a hole through the integument to which it applies its posterior stigmata, the host being stimulated to form a protective sheath round the parasite. The second moult occurs in this position. The puparium resembles that of *Digonochaeta setipennis*; the duration of the pupal stage varies from 17 to 38 days. Adults have been obtained in March at Setubal, Portugal, and in June and August in Holland. The duration of the second larval stage greatly exceeds that of the first or third; larvae in this stage are to be met with from July to the following May.

BACK (E. A.) & PEMBERTON (C. E.). **Effect of Cold-Storage Temperatures upon the Pupae of the Mediterranean Fruit Fly.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 7, 15th May 1916, pp. 251–260, 7 tables.

Although *Ceratitis capitata*, Wied., is mainly transported from one country to another in the larval stage within fruits, there are indications that the fly may be carried long distances in the pupal stage and be capable of producing infestation. It was therefore considered desirable to obtain data on the effect of cold-storage on the pupae. Experimental work with temperatures lower than 45° F. was conducted in a modern cold-storage plant; for temperatures between 49° F. and 57° F. ordinary refrigerators were used. Pupae from one to ten days old sifted from sand beneath host fruits were placed in storage in vials for varying periods. From observations on 173,318 pupae, it was concluded that none could survive exposure for longer periods than were necessary to kill eggs and larvae in host fruits maintained at similar temperatures [see this *Review*, Ser. A, iv, p. 124]. The critical temperature below which development into the adult state could not take place was about 50° F. The age of the pupa apparently had no direct bearing on its ability to withstand low temperatures.

SNYDER (T. E.). **Egg and Manner of Oviposition of *Lyctus planicollis*.**—*Jl. Agric. Research, Washington, D.C*, vi, no. 7, 15th May 1916, pp. 273–276, 4 plates.

Beetles of the genus *Lyctus* are of economic importance owing to the damage they do to seasoned timber. *L. planicollis* is a native American

species occurring in the southern parts of the United States. The winter is passed in the larval stage. At Washington, D.C., and at Falls Church, Va., adults emerged from infested wood in breeding cages at the end of February and the beginning of March, but emergence did not become general until the middle of April. The last adults appeared in July. At Baltimore, Md., emergence in a heated building took place in January. Mating occurs commonly during May and egg-laying begins a few days later. Eggs are deposited in hickory, ash and oak, in the open ends of pores in the sapwood, two eggs usually being laid together. The incubation period is about 10 days, and newly-hatched larvae appear in June. Pupation occurs during the following April. The presence of numerous larvae in the wood gives rise to the so-called powder-post condition. Injury to unfinished wood products can be prevented by adapting a system of inspection and methods of disposal of stock to the seasonal history of the insects. Finished products may be treated with creosote to prevent attack, but this substance stains the wood. The pores may be closed by the application of paraffin wax, varnish, or linseed oil. Sapwood which has been seasoned for less than 8 or 10 months is not liable to attack. Preventives should be applied before 1st March.

BUNKER (P. S.). **Report of Superintendent of Gypsy and Brown Tail Moth Work.**—*Ann. Rept. Park Commissioners, City of Fitchburg, Mass., for 1915, Fitchburg*, 1916, pp. 45–52, 3 plates. [Received 30th May 1916.]

The most effective single feature in the suppression of the gipsy moth [*Lymantria dispar*] is the thinning out of non-resistant trees, such as oak, grey birch, etc., upon which the larvae feed in early stages. Since dispersal is brought about by mechanical transport and by wind, it is essential that colonies should not be allowed to develop in hedges, fields, etc. The removal of non-resistant trees from roadsides and adjoining private property to a distance of from 25 to 50 feet from the road was carried out on a large scale during 1915, and resulted in about 90 per cent. reduction of infestation in residential, business and suburban districts. This measure was supplemented by the collection of egg-masses and spraying in the most seriously infested localities.

The most effective measure for the control of the brown-tail moth [*Euproctis chrysorrhoea*] is the removal of non-resistant species, these being practically the same as those attacked by the gipsy moth. Sprays can also be applied in spring against this species and against the elm leaf beetle [*Galerucella luteola*].

SURFACE (H. A.). **Compulsory Spraying of Trees.**—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 11, 16th March 1916. [Received 30th May 1916.]

By the regulations of the Nursery Inspection Law, owners of trees infested with injurious insect or fungus pests are required to spray the same if instructed to do so by the inspector. In case of neglect to carry out these instructions, spraying can be carried out by the Department of Agriculture at the owner's expense.

The Clover Leaf Weevil.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 19, 18th May 1916.

The clover leaf weevil [*Hypera variabilis*] has recently occurred in injurious numbers in the eastern part of Pennsylvania. There is no known method of controlling this pest, but it can be checked to a great extent by pasturing. Ploughing under red clover after the second season, materially reduces the numbers. Mowing the clover has a certain disadvantage, in that the weevils may survive on fallen leaves, etc., until the new growth has appeared.

SCHREIBER (A.). **Вредитъ-ли цвѣтущимъ растеніямъ опрыскиваніе ихъ инсектисидами.** [Whether flowering plants can be damaged by spraying them with insecticides.]—**«Труды Бюро по прикладной ботаникѣ.»** [*Bulletin of Applied Botany*], *Petrograd*, no. 4 (89), 1916, pp. 175–176.

The author made experiments in the summer of 1915 at Irkutsk on spraying plants of *Calendula officinalis* attacked by caterpillars of *Barathra (Mamestra) brassicae* with solutions of extract of *Aloe* and of *Veratrum album*. Although the plants were in full bloom, they were not damaged and afterwards gave a good crop of seed, though the insects were killed by the insecticide. This experiment confirms a similar experiment with tobacco by Glasenapp [see this *Review*, A, i, p. 370].

KOROLKOV (D. M.). **Крыжовниковая моль.** [*Zophodia convolutella*, Hb.].—**«Садъ и Огородъ.»** [*Orchard and Market-Garden*], *Moscow*, no. 2–3, February-March, 1916, pp. 64–66.

The author gives a short account of the life-history of the Pyralid, *Zophodia convolutella*, Hb., and its control. The adults are on the wing in spring and oviposit on the berries of currants and gooseberries; the larvae penetrate into the fruits and feed on their seeds and contents passing from one fruit to another. The larvae pupate in the soil and winter as pupae, the imago emerging in the following spring. The best remedies consist of the removal of injured berries and collecting the caterpillars, digging the soil in autumn and winter, and spraying in spring with a mixture of Bordeaux liquid (⅓ lb. of copper sulphate, ⅓ lb. of quick lime in about 3 gallons of water) and Paris green (⅓ oz. of green and 1½ oz. of quick lime in about 3 gallons of water) which prevents oviposition and poisons the larvae. Bushes exposed to the sun are avoided by the females and measures which improve ventilation are therefore advantageous.

SACHAROV (N.). **Отчетъ о дѣятельности Энтомологической Станціи за 1915 годъ.** [Report on the work of the Entomological Station for 1915.]—Published by the Entomological Station of Astrachan], *Astrachan*, 1916, 12 pp.

The insect pests recorded during the summer of 1915 include:—*Gryllotalpa gryllotalpa*, L., (*vulgaris*), which injured plants in market-gardens, especially early tomatoes; *Thrips tabaci*, Lind. (*communis*, Uzel), which was specially injurious in the first half of July; *Tingis*

pyri, F.: *Myzus cerasi*, F.; *Hyalopterus arundinis*, L. (*pruni*, F.) was present in large quantities on plums, apricots, peaches, and blackthorns; the migration of this species to *Phragmites communis* was first observed on 29th May; *Hyponomeuta malinellus*, Zell.; *Phlyctaenodes sticticalis*, L., the first generation of which attacked mustard, etc.; the second generation was less numerous and no special damage was noticeable; the caterpillars of the first generation of *Homoeosoma nebulella*, Hb., were reported on 15th June, the adults of the second generation appearing on the 2nd July; *Pieris brassicae*, L.; *Biston hirtarius*, Cl., the caterpillars of which injured quinces (*Cydonia vulgaris*), in some cases defoliating whole orchards; *Laphygma* (*Caradrina*) *exigua*, Hb., injuring vegetables and onions; *Barathra* (*Mamestra*) *brassicae*, L.; *Rhynchites bacchus*, L.; *R. auratus*, Scop.; *Polyphylla alba*, Pall.; *Serica brunnea*, L.; *Epicometis* (*Tropinota*) *hirta*, Pod.; *Eriocampoides limacina*, L. (*Selandria adumbrata*, Klug); *Trichiocampus* (*Cladius*) *viminalis*, Fall., the larvae of which injured poplar trees, but can be effectively checked by tanglefoot belts.

The following are also added to the pests recorded in Astrachan during 1912–1914 [see this *Review*, Series A, iii, p. 219]:—*Eriophyes tiliae*, Pagnst., on ornamental lime-trees; *E. brevitarsus*, Fock., and *E. nalepai*, Fock., on *Alnus glutinosa*; *Brachycolius noxius*, Mordw., on wheat; *Colopha compressa*, Koch, the galls of which were noticed on elm-trees; *Eriosoma* (*Schizoneura*) *lanuginosum*, Hart., on *Ulmus suberosa*; *Orthezia urticae*, L., on stems of hops; *Kermes variegatus*, Gmel., in cracks of the bark of oaks; *Eulecanium* (*Lecanium*) *vini*, Bch., on vines; *Chionaspis salicis*, L., on willows.

Lepidopterous pests included:—*Anarsia lineatella*, Zell., boring in young branches of *Oleaster*; *Phyllorycter* (*Lithocolletis*) *quercifoliella*, Zell., mining oak leaves; *Acrolepia assectella*, Zell., injuring onions; *Depressaria depressella*, Hb. (not *nervosa*, as stated in the above-mentioned list), the caterpillars of which injure the inflorescences of dill and other Umbelliferae; *Hemithea strigata*, Müll., the caterpillars of which were found on apple trees, as were also those of *Acrobasis obtusella*, Hb.; *Tortrix* (*Cacoecia*) *ribeana*, Hb.; *T.* (*C.*) *cerasana*, Hb.; and *T.* (*Pandemis*) *chondrillana*, H.S., on apple and pears; *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., and *Epagoge* (*Amphisa*) *rhombicana*, Schiff., on blackberries; *Tortrix politana*, Hw., on dill; *Ancylis* (*Phoxopteryx*) *comptana*, Froel; *Melicleptria* (*Heliothis*) *scutosa*, Schiff., the caterpillars of which live on *Artemisia scoparia*, which is planted to hold drifting sand; *Phytometra* (*Plusia*) *gutta*, Gn.; *Acronycta megacephala*, F., on leaves of poplars; the Hesperid, *Carcharodus alceae*, Esp., on mallows; *Polia* (*Mamestra*) *oleracea*, L., and *Scotogramma* (*M.*) *trifolii*, Rott., on tomatoes; *Arctia villica*, L., on wallflowers.

Coleoptera:—*Saperda populnea*, L., on poplars; *Pyrrhidium sanguineum*, L., the adults of which were occasionally shaken from apple trees, the larvae being found underneath the bark of oak; *Chalcoides aurata*, Marsh., the adults of which skeletonise the leaves of willows and aspen; *Plagiodera versicolor*, Laich., the larva and adults of which skeletonise willows; *Cassida murraea*, L., on apples.

Hymenoptera:—*Cimbex lutea*, L. (*saliceti*, Zadd.), on willows; *Pontania proxima*, Lep. (*Nematus valisnierii*, Hart.), the galls of which were found on willows, the larva appearing on 15th May and the adults

on 14th June; *P. salicis*, Christ (*Nematus gallarum*, Hart.), on red osier, the larva emerging from the galls on 8th October; *Micronematus abbreviatus*, Htg., on pear trees; *Trichiocampus* (*Cladius*) *viminalis*, Fall.; *Emphytus truncatus*, Klug, on strawberries, in May; *Rhabdophaga* (*Cecidomyia*) *salicis*, Schr., on willows.

Three stations for hiring apparatus were opened during the year, and notwithstanding the war and the scarcity of insecticides, they proved very valuable. A total of 25 sprayers were used and some 30,000 vine stocks, about 4,000 fruit-trees and over 160,000 tomato plants were sprayed; the machines were in use for 170 days by 133 growers. The cost of the management of these stations was £7 10*s*. 0*d*., and about £2 10*s*. 0*d*. was received for hire, besides £21 from the sale of insecticides. Some 3,500 copies of posters on insect pests were also published.

Experiments were also made with several new insecticides. London purple (1 lb. in about 100 gallons of water and 2 lbs. of lime) was tested under natural conditions on the caterpillars of *Hyponomeuta malinellus*; the death of some of the caterpillars occurred within 18 hours, and within three days only single individuals survived; it is thought that London purple may be effective in replacing Paris green and it is proposed to test it on other pests. Kerosene-lime emulsion (½ lb. of lime, 1 lb. of kerosene and 3 gallons of water, the emulsion being strained before use) proved very effective against *Aphis pomi*. The disadvantage of this emulsion is that it clogs the nozzle of the sprayer.

N. Sh. **Настоятельная необходимость устройства въ виноградникахъ гнѣздилищъ для птицъ.** [The urgent necessity of providing nests for birds in vineyards.]—Supplement to **«Садъ, Огородъ и Бахча.»** [*Orchard, Market-Garden and Bachza*], *Astrachan*, no. 2-3, February-March, 1916, pp. 13-15, 1 fig.

The value of tits, wrens, warblers and other birds in destroying *Phylloxera* and the caterpillars of *Polychrosis botrana* is emphasised, and the provision of nesting places in vineyards is urged.

Vostrikov (P.). **Птицы—помощники человѣка въ истребленіи вредныхъ насѣкомыхъ и выдающаяся въ этомъ отношеніи роль грача и скворца.** [Birds assisting man in the control of insect-pests and the important part played by rooks and starlings.]—Supplement to **«Садъ, Огородъ и Бахча.»** [*Orchards, Market-Garden and Bachza*], *Astrachan*, no. 2-3, February-March 1916, 13 pp., 5 figs.

This paper contains a general review of the assistance afforded by birds in destroying insect and other pests. In the government of Astrachan a very important and useful part in this respect is played by rooks (*Corvus frugilegus*) and starlings (*Sturnus vulgaris*). The former destroys the larvae of *Euxoa segetum*, *Dendrolimus segregatus*, *D. pini*, *Polyphylla fullo*, *P. alba*, locusts, *Lethrus apterus*, *Bothynoderes* (*Cleonus*) *punctiventris*, wireworms, and many other insects. Swarms of rooks and starlings often serve as an indication of the presence of egg-clusters of locusts. In one case the author witnessed the destruction by these birds of all the egg-clusters over an area of 567 acres.

ANUTCHIN (A.). **Кукурузный мотылекъ, его жизнь и борьба съ нимъ.** [*Pyrausta nubilalis*, Hb., its life-history and control.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 5, May, 1916, pp. 227-230, 5 figs.

Pyrausta nubilalis is very widespread in European Russia and in Siberia, and is particularly common in the South, injuring maize, millet, hemp and hops; in the province of the Don, where no hemp and hops are cultivated, it chiefly injures maize and to some extent millet. The various stages of the pest are described and figured; the eggs are laid about the middle of July on the surface of the stems and in two weeks the caterpillars emerge, feeding first on the surface and then penetrating into the stem, where they remain for the whole of their life. The caterpillars winter inside the stem, pupating only in April or May of the following year, the pupal stage lasting about three weeks. The usual remedy is the burning of the stems after the harvest, but in many steppe-estates the stems are purposely left over the winter to retain the snow; it is therefore suggested that experiments should be made with insecticides, applied at the time when the young, newly-hatched larvae are still on the surface of the stems.

OSSIPOV (N.). **Кравчикъ и мѣры борьбы съ нимъ.** [*Lethrus apterus*, Laxm., and measures for its control.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 5, May, 1916, pp. 238-245, 2 figs.

The adults of *Lethrus apterus* appear early in spring and prepare burrows along roads and similar uncultivated places in which each female lays from 8 to 12 eggs. These burrows are stored with food for the future larvae, consisting of fragments cut from plants, vines being especially damaged. The larvae hatch in 12 days and live for a month or more; the pupal stage lasts two weeks and the newly emerged beetles remain in the soil over the winter. Against this pest, trenches should be dug round plantations, the sides of the trenches being undercut so that the bottom is wider than the top. Where no trenches are practicable, the plantations should be surrounded with straw bands smeared with tar. Spraying with Paris green or any other arsenical must be done once as soon as the beetles appear and again during the period of the gathering of food supplies. Hand-picking should also be carried out at this time. The peasants in Bessarabia apply a remedy that is based on the inability of the beetles to creep up smooth surfaces. Each vine-stock is surrounded with a closed ring made of iron or wooden hoops, or specially prepared from sheet iron. These are kept on the plants for not more than one month and, if taken care of during the winter, will last for 10 years.

BORODIN (D. N.). **Первый отчетъ о дѣятельности энтомологическаго бюро и обзоръ вредителей Полтавской губерніи въ 1914 г.** [The first report on the work of the Entomological Bureau and a review of the pests of the govt. of Poltava in 1914.] **«Энтомологическое Бюро Полтавскаго Губернскаго Земства.»** [*The Entomological Bureau of the govt. of the Zemstvo of Poltava*], *Poltava*, 1915, 87 pp. [Received 1st June 1916.]

The object of this Bureau is to provide the agricultural population with practical advice and assistance, and a general account is given

of the manner in which this has been carried out by means of correspondence and posters.

Pests of cereals, etc., included :—*Locusta* (*Pachytylus*) *migratoria*, L. ; *Limothrips denticornis*, Hal., on rye ; *Stenothrips graminum*, Uzel, on oats ; *Haplothrips tritici*, Kurdj., on wheat ; *Eurygaster austriacus*, Schr. ; *E. integriceps*, Put., and *E. maura*, L., on wheat ; *Aelia acuminata*, L., on rye, together with *Notostira erratica*, L., which does not do important damage ; *Trigonotylus ruficornis*, Geoffr., on wheat during May and part of June ; *Delphax striatella*, Fall. ; *Macrosiphum granarium*, Kirby, of which a large outbreak occurred in some localities, 14 per cent. being attacked by *Aphidius* and 8 per cent. with fungus-diseases ; *Toxoptera graminum*, Rond., present in large numbers in June and July ; *Aphis rumicis* (*euonymi*) injuring maize and millet in some localities ; *Tetraneura ulmi*, Deg., galls of which were observed on elm trees ; *Pyrausta nubilalis*, Hb. ; *Trachea* (*Hadena*) *basilinea*, L. ; *Euxoa segetum*, Schiff. ; *Oria* (*Tapinostola*) *musculosa*, Hb. ; *Harpalus* (*Ophonus*) *calceatus*, Duft., on millet ; *Agriotes lineatus*, L., principally on tobacco, sunflower and beet ; *Athous niger*, L. ; *Lema melanopa*, L. ; *Chaetocnema aridula*, Gyll. ; *Phyllotreta vittula*, Redt. ; *Pentodon idiota*, Hbst. ; *Melolontha melolontha*, L. ; *Amphimallus solstitialis*, L. ; *Anisoplia austriaca*, Hbst. ; *A. cyathigera*, Scop. ; *A. segetum*, Hbst. ; *Lethrus apterus*, Laxm. ; *Mayetiola destructor*, Say ; *Contarinia tritici*, Kirby ; *Sitodiplosis mosellana*, Gehn., (*Contarinia aurantiaca*, Wagn.) ; *Oscinella frit*, L. ; *Chlorops taeniopus*, Meig. ; *Meromyza saltatrix*, L., on rye ; *Chortophila* (*Adia*) *genitalis*, Schnabl. ; *Cephus pygmaeus*, L. ; *Pachynematus clitellatus*, Lep. ; *Isosoma noxiale*, Portch. ; and *Pediculopsis graminum*, Reut.

Pests of orchards and forests :—*Psylla pyricola*, Forst., *P. mali*, Forst., and *Chermes viridis*, Ratz., on *Abies balsamea*, *A. elegantissima* and other Conifers ; *Aphis pomi*, Deg., *A. crataegi*, Koch, *Aphis idaei*, Goot, and *Aphis grossulariae*, Kalt., which were successfully controlled with tobacco extract ; *Myzus cerasi*, F. ; *Rhopalosiphum ribis*, Koch ; *Hyalopterus arundinis*, L. (*pruni*, F.) against which carbolic or kerosene emulsion and quassia soap proved successful ; *Macrosiphum rosae*, L. ; *Chionaspis salicis*, L. ; *Lepidosaphes ulmi*, Bch. (*Mytilaspis pomorum*, L.) ; *Eulecanium* (*Lecanium*) *persicae*, Geoff. ; *Hyponomeuta malinellus*, Zell. ; *H. variabilis*, Zell. ; *Tortrix* (*Cacoecia*) *rosana*, L. ; *T.* (*C.*) *lecheana*, Hb., on apples, not having been previously reported as a pest ; *T.* (*Pandemis*) *heparana*, Schiff., on apples ; *T.* (*P.*) *ribeana* Hb., *Cydia pomonella*, L. ; *C.* (*Grapholitha*) *funebrana*, F. ; *Cossus cossus*, L. ; *Zeuzera pyrina*, L. ; *Aporia crataegi*, L., the spread of which reached a maximum in 1908–1911, since when its numbers have largely decreased ; *Lymantria dispar*, L. ; *Malacosoma neustria*, L. ; *Euproctis chrysorrhoea*, L. ; *Cheimatobia brumata*, L. ; *Hibernia defoliaria*, L. ; *Abraxas grossulariata*, L. ; *Chloroclystis rectangulata*, L., on apples ; *Galerucella viburni*, Payk. ; *Sciaphobus squalidus*, Gyll. ; *Hylobius abietis*, L. ; *Pissodes notatus*, F. ; *Anthonomus pomorum*, L. ; *Apion pomonae*, L. ; *Byctiscus betulae*, L. (*Rhynchites betuleti*, F.) ; *R. auratus*, Scop. ; *R. bacchus*, L. ; *R. giganteus*, Kryn. ; *R. pauxillus*, Germ. ; *R. betulae*, L. ; *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz. ; *Hylesinus fraxini*, F. ; *Myelophilus piniperda*, L. ; *Ips sexdentatus*, Boern. ; *Melolontha melolontha*, L. ; *M. hippocastani*, F. ; *Polyphylla fullo*, L. ; *Epicometis* (*Tropinota*) *hirta*, Poda ; *Cetonia aurata*, L. ;

Ardis bipunctata, Klg.; *Eriocampoides limacina*, L. (*Selandria adumbrata*, Klug) on cherries; *Neurotoma flaviventris*, Ritz.; *Lyda clypeata*, Kl., on pears; *Hylotoma rosarum*, F.; *Pteronus* (*Nematus*) *ribesii*, Scop., on currants and gooseberries; and *Lophyrus pini*, L.

Miscellaneous pests included :—*Aphis gossypii*, Glov., on cucumbers, melons, etc.; *Aphis brassicae*, L.; *Siphonophora scabiosae*, Buckt., on tobacco; *Acyrthosiphon pisi*, Kalt., on clover, lucerne, peas, vetches; *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.), on rape and cabbage; *Cydia* (*Grapholitha*) *dorsana*, F., on peas; *Phlyctaenodes* (*Loxostege*) *sticticalis*, L.; *Homoeosoma nebulella*, Hb., on sunflowers; *Pieris brassicae*, L.; *P. rapae*, L.; *P. napi*, L.; *Barathra* (*Mamestra*) *brassicae*, L.; *Euxoa segetum*, Schiff., on fodder- and sugar-beet, etc.; *Meligethes aeneus*, F., which occurs wherever rape and similar oil-bearing plants are grown; *Agriotes lineatus*, L., and *Athous niger*, L., on beet, rape, tobacco, etc.; *Aphthona euphorbiae*, Schr., on linseed; *Phyllotreta atra*, F.; *P. nemorum*, L.; *Psylliodes attenuata*, Koch, on hemp; *Chaetocnema concinna*, Chevr., and *Cassida nebulosa*, L., on beet; *Bruchus pisorum*, L.; *Bothynoderes* (*Cleonus*) *punctiventris*, Germ.; *Tanymecus palliatus*, F., on sunflowers; *Sitones lineatus*, L.; *Ceuthorrhynchus macula-alba*, Hbst.; *Lethrus apterus*, Laxm.; *Chortophila* (*Anthomyia*) *brassicae*, Bch.; *Hylemyia antiqua*, Meig.; and *Athalia colibri*, Christ (*spinarum*, F.), on rape and mustard, the larvae being attacked in some cases by an unknown fungus or bacterial disease.

PLIGINSKY (V. G.). **Животныя, вредившія с.-х. культурамъ въ Курской губерніи въ 1915 г.** [Animals injurious to cultivated crops in the govt. of Kursk in 1915.]—**« Курское Губернское Земство. Энтомологическое Бюро.»** [*The Entomological Bureau of the Zemstvo of the govt. of Kursk*], *Kursk*, 1916, 20 pp., 10 figs.

The following is a list of the pests observed :—Arachnoidea: *Tyroglyphus farinae*, Koch, in buckwheat meal; *Eriophyes tiliae*, Pagnst., on leaves of lime trees; *E. ribis*, Nal., on black currants; *E. pyri*, Pagnst., on pears, and rarely on apples; *E. pyri* var. *variolata*, Nal., on service trees; *E. macrochelus*, Nal., and *E. macrorhynchus*, Nal., on maples; *E. padi*, Nal., on plums, having evidently been imported; *Phyllocoptes schlechtendali*, Nal., on apples; *P. gymnaspis*, Nal., on maples.

Orthoptera :—*Locusta* (*Pachytylus*) *migratoria*, L.; *Gryllotalpa gryllotalpa*, L. Rhynchota :—*Eurygaster integriceps*, Osh.; *Tingis pyri*, F.; *Eupteryx stellulata*, Burm., which is found on maple, but may also occur on apple; *Typhlocyba rosae*, L.; *Psylla mali*, Schm.; *Pemphigus spirothecae*, Licht., on poplars; *Tetraneura ulmi*, Deg., on elms, migrating in the middle of the summer to roots of grasses; *Eriosoma* (*Schizoneura*) *ulmi*, Deg.; *Chaetophorus aceris*, on maples; *Siphonophora rosae*, L.; *Rhopalosiphum ribis*, Buckt., on currants, this species being heavily parasitised; *Hyalopterus arundinis*, L. (*pruni*, F.), on plums; *Myzus cerasi*, F., on cherries; *Aphis pomi*, Deg., which was kept in check by Syrphids and by *Coccinella 7-punctata*, L., and *Adalia bipunctata*, L.; *A. pyri*, Koch, *A. rumicis*, L. (*papaveris*, F.), and *A. brassicae*, L.; *Aspidiotus ostreaeformis*, Curt., on plums; and *Lepidosaphes ulmi* (*Mytilaspis pomorum*) present in large numbers on old apple and pear trees.

Lepidoptera :—*Aporia crataegi*, L. ; *Pieris brassicae*, L. ; *P. rapae*, L. ; *Orgyia antiqua*, L. ; *Stilpnotia* (*Leucoma*) *salicis*, L., on willows ; *Euproctis* (*Porthesia*) *chrysorrhoea*, L. ; *Malacosoma neustria*, L. ; *Lymantria dispar*, L. ; *Barathra* (*Mamestra*) *brassicae*, L. ; *Cheimatobia brumata*, L., the control of which was difficult owing to the want of a supply of tanglefoot ; *Arctia caja*, L. ; *Cossus cossus*, L. ; *Galleria mellonella*, L. ; *Olethreutes variegana*, Hb., on plums ; *Cydia* (*Grapholitha*) *funebrana*, Tr. ; *C. pomonella*, L. ; *Hyponomeuta malinellus*, Zell. ; *H. padellus*, L. ; *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) ; *Lyonetia clerckella*, L.

Coleoptera :—*Byturus tomentosus*, F. ; *Tenebroides mauritanicus*, L., which is considered rather a useful insect, especially in the larval stage ; *Laemophloeus testaceus*, F. ; *Agriotes lineatus*, L. ; *Tenebrio molitor*, L. ; *Sitodrepa panicea*, L. ; *Lytta vesicatoria*, L., on ash trees ; *Lema melanopa*, L., on oats ; *Batophila rubi*, Payk., on raspberries ; *Bruchus* (*Laria*) *pisorum*, L. ; *Phyllobius oblongus*, L. ; *Sciaphobus squalidus*, Gyll. ; *Bothynoderes punctiventris*, Germ. ; *Ceuthorrhynchus macula-alba*, Hbst., which attacks the heads of poppies ; *Calandra granaria*, L. ; *Anthonomus pomorum*, L. ; *Apion aestivum*, Germ., the economic importance of which is considered negligible ; *Rhynchites pauxillus*, Germ. ; *R. aequatus*, L. ; *R. bacchus*, L. ; *Byctiscus betulae*, L. ; *Scolytus* (*Eccoptogaster*) *rugulosus*, Ratz. ; *Melolontha melolontha*, L. ; *Polyphylla fullo*, L. ; *Anisoplia cyathigera*, Scop. ; *Epicometis* (*Tropinota*) *hirta*, Poda ; *Psylliodes attenuatus*, Koch ; *Cassida nebulosa*, L., and *C. nobilis*, L.

Diptera :—*Chortophila brassicae*, Bch.

Hymenoptera :—*Emphytus grossulariae*, Kl., *Eriocampoides limacina*, L., and *Hoplocampa fulvicornis*, Klug.

Galkov (V. P.). **Опытъ окуриванія тлей табачнымъ дымомъ.** [An experiment on fumigating Aphids with tobacco smoke.]—**« Курское Губернское Земство. Энтомологическое бюро.** [*The Entomological Bureau of the Zemstvo of the govt. of Kursk*]. *Kursk*, 1916, 4 pp., 3 figs.

This is a detailed account of experiments on fumigating with tobacco smoke against Aphids. The apple and cherry trees of the orchard selected for the experiment were infested with *Aphis pomi*, de G. (*mali*, F.), and *A. cerasi*, F. After a fumigation lasting from 7 to 10 p.m., only the very small forms remained alive, and after a second fumigation the next evening, no living Aphids were left, nor could any be found ten days later. The orchard had an area of about half an acre and 180 lb. of tobacco dust and six bags of hay were required for the fumigation. In another plum orchard fumigation was applied against *Hyalopterus arundinis*, L. (*pruni*, F.), with complete success. Good results were also obtained by powdering with tobacco dust in some nurseries. This was done early in the morning, before the dew was dry. Further investigations on the effect of tobacco smoke on Psyllids and Aphids are urged.

PLIGINSKY (V. G.). **Можно-ли по погодѣ предвидѣть распространеніе вредителей сельскаго хозяйства?** [Is it possible to foresee the spread of pests according to the weather?] **« Ежемѣсячный бюллетень метеорологической сѣти Курскаго Губернскаго Земства. »** [*Monthly Bulletin of the Meteorological System of the Zemstvo of the govt. of Kursk*], *Kursk*, no. 33, April (1914), 1915, pp. 16–18.

A short account is given of the relation between meteorological conditions and outbreaks of insect pests. In view of the importance of this matter as a means of being able to predict the possibilities of outbreaks, all persons concerned are requested to send any observations on these points to the Entomological Bureau.

KITCHUNOV (N. I.). **Ягодныя культуры.** [Cultivation of bush-fruit.] —Supplement to **« Прогрессивное Плодоводство и Огородничество. »** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, 1916, 139 pp., 40 figs.

The most serious pest of strawberries is the larva of *Melolontha melolontha*, which prefers their roots to those of all other plants, except salad; the latter is therefore sown among strawberries as a trap crop. Other pests of strawberries are *Euxoa segetum*, *Phytometra* (*Plusia*) *gamma*, *Acronycta rumicis*, *Anthonomus rubi* and *Otiorrhynchus sulcatus*.

Pests of currants include *Pteronus ribesii* (*Nematus ventricosus*), *Aphis ribis*, *A. pomi* (*mali*), which can be controlled by spraying with kerosene emulsion or quassia, *Aegeria* (*Sesia*) *tipuliformis*, *Thamnonoma* (*Fidonia*) *wavaria*, and *Lepidosaphes ulmi* (*Coccus conchiformis*).

Gooseberries are attacked by *Pteronus ribesii*, *Aphis grossulariae*, and *Abraxas grossulariata*.

Raspberries are injured by *Byturus tomentosus*, *Anthonomus rubi*, *Pentatoma baccarum*, *P. bicolor*, *Sesia hylaeiformis*, *Aristotelia* (*Gelechia*) *micella*, which oviposits underneath the bark of the young shoots, *Malacosoma* (*Gastropacha*) *neustria* and *Larentia* (*Geometra*) *albicillata*.

Четвертый бюллетень Сухумской Садовой и Сельскохозяйственной Опытной Станціи. (За время отъ 1 мая по 1 октября 1915 года). [The Fourth Bulletin of the Suchum Horticultural and Agricultural Experimental Station. (For the period from 1st May to 1st October 1915)], *Suchum*, 1916, 60 pp.

Owing to the Entomologist having been called to the colours, the Entomological Branch of the Station was closed, and only some scattered information on insect pests is given in this Bulletin. Citrus plants suffered heavily from *Aspidiotus citri* [*sic*] and other scale-insects. Spraying with quassia, tobacco extract, carbolic emulsion, Paris green and kerosene emulsion was carried out, but only the last-named, when used at a strength of 10 per cent., was effective.

SHTCHERBAKOV (Th.). **Біологическій циклъ видовъ рода** *Apion*, Hbst. (Coleoptera, Curculionidae), **живущихъ на красномъ клеверѣ** (*Trifolium pratense*). [The biological cycle of the species of the genus of *Apion*, Hbst. (Coleoptera, Curculionidae), living on red clover (*Trifolium pratense*).]— **« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xv, no. 4, 28th March 1916, pp. 529–557.

Observations on the biology of *Apion* were made at the Shatilov Experimental Agricultural Station in 1914 and 1915, the species studied being *A. trifolii*, L., and *A. apricans*, Hbst. In both years the weevils appeared at the end of April, the maximum numbers being reached in the second half of May. The view of A. Sopotzko, that they concentrate first on wild clover and afterwards migrate to the cultivated varieties, has not been confirmed, the insects being fairly equally divided on both. The process of oviposition and the life-history are described in detail. The eggs are deposited exclusively in unopened, green flower-heads and were never found in unfolded heads or in leaf buds. Parthenogenesis does not appear to occur. The life of the larva lasts on an average 17 or 18 days, during which time it devours seven or eight ovaries. The whole cycle of development of the insect from egg to imago lasts 29 or 30 days. The newly emerged weevils remain sexually immature during the remainder of the summer and hibernate in a state of diapause. Two Chalcidoid parasites of the larvae and pupae were observed; they have not yet been identified.

DEMOKIDOV (K. E.). **Къ біологіи чайной моли**, *Parametriotes theae*, Kusn. [On the life-history of the tea moth, *Parametriotes theae*, Kusn.]— **« Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xv, no. 4, 28th March 1916, pp. 618–626, 8 figs.

The author investigated during 1910–1914 the pests of the tea plantations in the province of Batum. The following insects were found:—*Toxoptera theaeicola*, Buckt., *Pulvinaria floccifera*, Westw., *Parlatoria* sp., *Thrips* sp., *Eriophyes theae*, Watt., *Tetranychus bioculatus*, Wood-Mason, and *Parametriotes theae*, Kusn. The last-named appears to be the most dangerous. It winters on the tea bushes as a caterpillar, the larger ones living in mines at the end of shoots, while the smaller remain inside the leaves. This is in accordance with the normal condition of the life of the larvae, the first part of which takes place in leaves, and the second one in the shoots. The mines appear at first as minute, brown-grey spots and increase in size with the growth of the caterpillars. The migration of the caterpillars from the leaves to the shoots begins in September or October in the case of the early caterpillars, while the late ones remain inside the leaves over the winter and pass into the shoots in the following spring. In warm winters they remain active and none of them are left in the leaves at the beginning of spring, while in cold winters they may still be found in the leaves in the second half of April. The caterpillars which emerge from the leaves in autumn are 3 or 4 mm. long, and penetrate exclusively into the still soft shoots of the year, showing a marked preference for the most tender part of the shoot toward the apical bud. A shoot

thus attacked stops growing and gradually withers. The caterpillars that hibernate in the leaves usually penetrate in the spring into the young buds, just then beginning to grow and giving rise to the shoots for the first tea harvest. The presence of the insects in such shoots shows its effect about the beginning of May. They begin to pupate in the first half of June inside the damaged shoots; pupation takes place during the following two months and lasts about a fortnight, the adults being thus on the wing from the end of June until the end of August. Besides tea, *Camellia japonica* is attacked, and as no injuries to local plants were observed, it is thought that this pest has been imported with these two plants from China. The caterpillars are parasitised by one Braconid and two Chalcidoids of the genera *Elasmus* and *Pteromalus*. The remedies suggested are the burning of the shoots or twigs removed during the usual winter pruning and the cutting and burning of attacked twigs and shoots during the first half of April. Trapping the adults with lights or molasses should also be tried.

KUSNETZOV (N. J.). **Описаніе** *Parametriotes theae*, gen. n., sp. n. (Lepidoptera Tineidae), **новаго вредителя чайнаго куста въ Закавказьѣ.** [Description of *Parametriotes theae*, gen. n., sp. n., a new pest of tea in Transcaucasia.]—**«Русское Энтомологическое Обозрѣніе.»** [*Revue Russe d'Entomologie*], *Petrograd*, xv, no. 4, 28th March 1916, pp. 626–652, 34 figs.

This is a description of the moth referred to in the previous paper. The author is of opinion that this insect has been imported from China, India or Ceylon, though it has not yet been recorded as a pest in those countries. An English translation of the description is appended to the paper.

ROBERTS (A. W. R.). **Report on Aphidae, 1915.**—*Lancashire Naturalist, Darwen*, ix, no. 98, May 1916, p. 38.

The following Aphids are recorded:—*Brachycolus stellariae*, Hardy, on *Stellaria holostea*; *Pemphigus bursarius*, L., *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., and *Lachnus piceae*, Wlk., on *Picea alba*.

MATSUMURA (S.). **Synopsis of the Economic Syrphidae of Japan.**—*Entom. Mag., Kyoto, Japan*, ii, no. 1, March 1916, pp. 1–29, 1 plate. [Received 1st June 1916.]

Descriptions of a large number of new and other Syrphids said to be of economic importance are given in this paper with keys to the genera and species. Their economic relations are not, however, stated.

HEWITT (C. G.). **The Introduction and Establishment in Canada of the Natural Enemies of the Brown-Tail and Gipsy Moths.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 1, January 1916, pp. 20–21. [Received 6th June 1916.]

The brown-tail moth [*Euproctis chrysorrhoea*] occurs at present in New Brunswick and Nova Scotia, while the gipsy moth [*Lymantria dispar*] has reached to a distance of about 50 miles from the boundary.

In anticipation of the further spread into Canada of these two insects, seven species of parasites and a predaceous beetle, *Calosoma sycophanta*, have been successfully introduced and at present are maintaining themselves successfully on the brown-tail moth and certain native insects.

MacLaine (L. S.). **Rearing the Parasites of the Brown-Tail Moth in New England for Colonization in Canada.**—*Agric. Gaz. Canada, Ottawa*, iii, no, 1, January 1916, pp. 22-25, 5 figs. [Received 6th June 1916.]

The Hymenopterous parasite, *Apanteles lacteicolor*, Vier., the Tachinid, *Compsilura concinnata*, Meig., and the predaceous beetle *Calosoma sycophanta*, L., have been reared in Massachusetts for liberation in those parts of Canada in which the brown-tail moth [*Euproctis chrysorrhoea*] was present. *A. lacteicolor* has two or three generations annually and after emerging from larvae of the brown-tail moth is able to attack the larvae of *Datana* or *Hyphantria*. The parasite is forwarded in the pupal stage and the cocoons are placed in cold storage to retard development until they can be liberated in the field. *C. concinnata* has two or three generations each year and is known to be able to parasitise about 50 different species of insects. *C. concinnata* was reared from larvae of the gipsy moth rather than from those of the brown-tail moth, owing to the poisonous nature of the hairs of this species. Transport was effected in a manner similar to that of *A. lacteicolor*. The best method of colonising *C. sycophanta* is to collect beetles in the adult stage from young oak woods. They are shipped in colonies of 100, containing equal numbers of each sex. When placed in wooden boxes covered with wire mosquito netting and packed in damp moss, they are able to travel long distances with a low percentage of mortality.

Hewitt (C. G.). **Outline of Entomological Work projected for 1916.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 5, May 1916, pp. 400-402.

Work connected with insects affecting field crops will include the carrying out of control measures against locusts and cutworms, and investigations on white grubs, onion maggots and Cecidomyid flies attacking cultivated grasses and cereals. In Nova Scotia observations on the best method of controlling the bud-moth [*Eucosma ocellana*], fruit-worms and other insects affecting the apple will be continued. New insecticides will be tested in orchards in the Annapolis Valley. In the Niagara district investigations on Aphids attacking apples and nursery stock will be continued. In British Columbia new work will include the study and control of the pear thrips [*Taeniothrips pyri*] in Vancouver, of *Otiorrhynchus ovatus* (strawberry weevil), and of the codling moth [*Cydia pomonella*] in the Okanagan Valley. With reference to insects affecting shade and forest trees, it is proposed to investigate forest conditions in Quebec and Northern Ontario, special attention being paid to boring insects in spruce and pine. The increased planting of trees on prairie farms will render necessary a study of insects attacking such trees. The borer of western cedar and bark beetles will be investigated in British Columbia, also the alternate

hosts of the green aphis and *Chermes* affecting conifers. Insects injurious to greenhouse and garden plants and stored products will be studied with a view to determining their life-histories and methods of control. Observations on, and introduction of parasites of the gipsy moth [*Lymantria dispar*], brown-tail moth [*Euproctis chrysorrhoea*], tent caterpillars [*Malacosoma*], etc., will be continued.

SANDERS (G. E.) & BRITTAIN (W. H.). **Results from spraying in Nova Scotia.**—*Dominion of Canada Dept. Agric., Entom. Branch, Ottawa,* Circ. no. 7, 1916, 11 pp. [Received 14th June 1916.]

This paper records the experimental data obtained between 1911 and 1914 inclusive as to the effect of spraying on certain varieties of apples. The results show a marked increase in the quantity of marketable fruit, a general improvement in quality and a rise in profits. A spraying calendar for apple orchards in Nova Scotia is given.

GOOD (C. A.). **A Few Observations on the Apple Maggot Parasite,** *Biosteres rhagoletis*, **Richmond.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 5, May, 1916, p. 168.

An account is given of the method of oviposition of *Biosteres rhagoletis*. This parasite probably causes high mortality among the larvae and pupae of the apple maggot [*Rhagoletis pomonella*] in Nova Scotia.

GIBSON (E. H.). **Some 1915 Notes on a few common Jassoidea in the Central Mississippi Valley States.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 5, May, 1916, pp. 177–179.

Draeculacephala mollipes, Say, was abundant throughout the season, especially in northern Arkansas, where maize was considerably injured during early summer. Eggs were apparently only deposited on grain, grasses and grass-like plants. *Diedrocephala versuta*, Say, became numerous in late summer, attacking cow-peas, lucerne, and ornamental plants in Missouri. *D. coccinea*, Say, was observed on weeds and ornamental trees and shrubs, including American holly and magnolia. *Phlepsius irroratus*, Say, attacked lucerne and clover throughout the central valley as well as various grains during the spring months. The nymphs and adults caused injury by feeding on the stems and were active during both the day and night. *Agallia sanguinolenta*, Prov. (clover leaf-hopper), together with *Empoasca mali*, caused some damage to lucerne and red clover in south-east Missouri in the early summer, but was easily captured by the use of a hopperdozer. This species was able to feed actively during cold days in winter. *E. mali*, Le B., attacking lucerne, clover, and other crops, was the most injurious species found during the year. In southern Illinois, there were probably at least six generations during the year. This species, as well as the preceding, may be important in spreading yellow and brown leaf spot of lucerne, due to *Pseudopeziza medicaginis* and *Coletotrichum trifolium* respectively. Other Jassids common during the year were:—*Pediopsis viridis*, Fitch; *Agallia constricta*, Say; *Cicadula 6-notata*, Fall.; *Deltocephalus inimicus*, Say; *D. nigrofrons*, Forbes; *Athysanus exitiosus*, Uhl.; *A. bicolor*, van D.; *Platymetopius frontalis*, van D.; *Eutettix seminuda*, Say; *Typhlocyba comes*, Say.

SICH (A.). **Life cycle of *Tortrix viridana*, L.**—*Proc. South London Entom. Nat. Hist. Soc., London*, 1915–16, pp. 15–20. [Received 10th June 1916.]

In the south of England *Tortrix viridana*, L., appears in the adult stage during June. Eggs are laid in pairs in June or July, being probably placed on the bark of the oak branches and are covered with scales from the body of the female and with débris from the bark. The larva hatches in the following April or at the beginning of May and enters the opening buds. During the later stages, the larva feeds within the rolled leaves. Pupation takes place at the end of May on the same or on an adjoining plant; the duration of this stage is from two to three weeks. In captivity, pairing took place soon after emergence and egg-laying began a few hours later. The natural enemies of the larva include predaceous Rhynchota and the Ichneumon, *Pimpla maculator*, F.

BUNNETT (E. J.). **The Maple Aphis and its Dimorphic Larva.**—*Proc. South London Entom. Nat. Hist. Soc., London*, 1915–16, pp. 21–24, 1 plate. [Received 10th June 1916.]

Chaitophorus aceris, L. (maple aphis) occurs in Britain on *Acer pseudoplatanus* (sycamore), *A. platanoides* (Norway maple), *A. campestre* (field maple), *A. monspessulanum* (Montpelier maple) and *A. negundo* (box-elder). The alate and apterous viviparous females of this species are able to produce pseudomorphic larvae in addition to the normal type. Specimens of the abnormal form were obtained in captivity and in the open during June and July 1914; they were observed to pass through one moult.

PRICE (W. J.). **Report of Inspection Work, 1914-1915.**—*10th Rept. State Entomologist and Plant Pathologist, Virginia, 1914–1915, Richmond*, 1916, pp. 9–15, 4 tables. [Received 6th June 1916.]

Inspection work during 1914–1915 consisted of the examination of all fruit and shade trees and ornamental plants grown in nurseries, examination being mainly carried out from July to September. Orchards were inspected and information given as to the control of San José scale [*Aspidiotus perniciosus*], green and rosy apple aphis [*Aphis pomi* and *A. sorbi*], and woolly aphis [*Eriosoma lanigerum*]. Imported nursery stock was very free from insects, the woolly aphis being the only one of importance.

SCHOENE (W. J.). **Court Decision Upholding the Cedar Rust Law.**—*10th Rept. State Entomologist and Plant Pathologist, Virginia, 1914–1915, Richmond*, 1916, pp. 16–29. [Received 6th June 1916.]

As the result of an appeal made by the owners of certain cedar trees against an order for destruction issued by the State Entomologist of Virginia, the court decided that the Cedar Rust Law must be upheld. Compensation for damage to the property resulting from the removal of the trees was awarded.

SMITH (L. B.). **Report on the Investigation of Insects Affecting Truck Crops in Virginia.**—*10th Rept. State Entomologist and Plant Pathologist, Virginia, 1914–1915, Richmond*, 1916, pp. 30–32. [Received 6th June 1916.]

Macrosiphum solanifolii, Ashm. (potato aphis) attacks potato, asparagus, egg-plants, peas and clover. When occurring on potatoes or egg-plants, the best method of control is to spray with a mixture consisting of 6½ ozs. nicotine sulphate to 50 U.S. gals. Bordeaux-arsenate of lead. The following flea-beetles have been observed on a variety of food plants :—*Epitrix parvula*, F., *E. cucumeris*, Harr., *E. fuscula*, Cr., *Chaetocnema confinis*, Lec., *C. pulicaria*, Mels., *C. denticulata*, Ill., *Systena taeniata*, Say, and *Phyllotreta vittata*, F. Maize is attacked when from 2 to 12 inches high, and injury is most severe in hot, dry weather. A mixture consisting of 1,920 lb. slaked lime and 80 lb. Paris green was found to act both as a direct poison and a repellant. *Blepharida rhois*, Forst. (sumac flea-beetle), a pest of the shade tree sumac, pupates during July in the soil at the base of the host tree and can thus be destroyed by breaking up the soil during this month. The larvae and adults on the trees can be controlled by lead arsenate spray, at a strength of 3 lb. to 50 U.S. gals. water.

SMITH (L. B.). **The Green Pea Aphid; its Life-History in Eastern Virginia.**—*10th Rept. State Entomologist and Pathologist, Virginia, 1914–1915, Richmond*, 1916, pp. 32–63, 4 figs., 3 plates, 5 tables. [Received 6th June 1916.]

Acyrthosiphon (*Macrosiphum*) *pisi*, Kalt. (green pea aphis) causes serious injury every year to pea crops in Eastern Virginia. Attack is followed by the stunting of the plant, by the assumption of a yellow colour, by the malformation of leaves and pods and, in severe cases, by the death of the plant. Other host plants include *Vicia* spp. (vetches), *Trifolium incarnatum* (crimson clover), *T. pratense* (red clover), *Lathyrus odoratus* (sweet pea), *Lespedeza* sp., *Medicago sativa* (lucerne), *Melilotus alba* (sweet clover), etc. The different hosts are attacked at varying periods of the year, so that there is practically no season in which the insect is not present. In the case of green peas, the autumn crop is usually the most severely injured. The winter is passed on clovers, lucerne and sweet peas. In spring, migration to the early crop of peas takes place between 20th March and 15th April. Between 20th June and 10th July a summer migration takes place to sweet clover, vetches and *Lespedeza* sp.; between 1st September and 15th September a return is made to the autumn pea crop, while the winter hosts are reached between 15th November and 15th December. Winged forms have also been found on cowpeas and soy beans in August and on kidney beans in August and September. In Eastern Virginia it is probable that many individuals pass the entire year on clovers if these are available. The winter seems to be passed through by viviparous females, since no oviparous forms or eggs have been found. Reproducing females and nymphs are unable to withstand prolonged exposure to temperatures between 25° F. and 40° F.

Dispersal from clover, etc., to pea fields is effected by both winged and wingless forms, the latter being important in securing an equal distribution throughout the field. Breeding experiments with *A. pisi*

yielded 21 generations between 1st May and 10th December in 1914. The age at which reproduction began varied from 7 to 26 days; the length of the reproductive period varied from 4 to 36 days and the death of the female usually occurred on the day following the cessation of reproduction. The average duration of life of viviparous females was 31·7 days and of hibernating females 134 days. The maximum number of young produced by any female was 142, reproduction being most rapid in July, August and the beginning of September. Wingless viviparous females mature more rapidly and have greater powers of reproduction than winged forms.

SMULYAN (M. T.). **Observations on the Life-Histories and Habits of the Species of Aphides most common on the Cultivated Apple (*Malus malus*) in Virginia (Blacksburg), during the Season of 1915.**—*10th Rept. State Entomologist and Plant Pathologist, Virginia, 1914–1915, Richmond*, 1916, pp. 64–75. [Received 6th June 1916.]

Apple trees in Virginia are attacked by *Aphis sorbi*, Kalt. (rosy apple aphis), *A. avenae*, F. (oat aphis), and *A. pomi*, de G. (green apple aphis). The last-named species remains on the apple throughout the year, while *A. sorbi* migrates to plantains and *A. avenae* to cultivated and wild grain and grasses. *A. avenae* was the first species to appear in spring, being found on 25th March on mature trees before the buds were open. These individuals died from lack of food, and actual feeding was noted on 8th April when the buds were opening. No definite relation was observed between the time of hatching and the unfolding of the buds. Stem-mothers were reproducing by 21st April and nine days later winged forms appeared. This species probably causes injury by feeding on the blossoms which, as a result, drop early. Coccinellid larvae were abundant by the second week in May and destroyed numbers of Aphids. Migration on the part of the latter was completed by 31st May. Winged, viviparous, return migrants were found on apple on 2nd October when they were depositing sexual young. The latter reached maturity by the middle of October, when egg-laying began and continued until December. Viviparous forms began to decrease in numbers during the third week in November. In some cases males of *A. sorbi* were observed pairing with females of *A. avenae*. Eggs were deposited in protected places in the bark or around the buds of twigs one or more years old of mature trees.

A. sorbi is almost confined to bearing trees. The first young were observed on 7th April and a number of terminal buds began to open on the next day, although many were still closed. There is thus no definite relation between the time of hatching and the time of the unfolding of the buds. Hatching was completed by 20th April. Curling of the leaves was first observed on 22nd April, and on 24th young of the second generation were found. Mature females of the second generation were present on 5th May. Colonies were most numerous in thick trees in positions in which the young forms were protected from the sun; a few individuals of *A. avenae* were usually present. Spring migrants were first observed on 18th May, about a week after most of the petals had fallen. A few individuals were present on the tender foliage throughout July after the majority had migrated to plantains. Some migration was observed as late as the

first week in August. Natural enemies included Coccinellid larvae during the early part of the season and Dipterous larvae at a later period. Return migrants were found on 2nd October; males were observed on 8th and a mature oviparous female on 13th October. The beginning of egg-laying was not determined. Viviparous apterous forms occurred on *Plantago major* and *P. lanceolata* until 4th December. On the apple viviparous and oviparous forms remained until the middle of that month.

A. pomi is found on the young growth of nursery and young orchard trees. This species was first observed on 6th April and hatching extended over at least three weeks; it was not common until the middle of June and began to decrease in numbers during the second half of July. Mature males were first seen on 22nd September and mature oviparous females a week later. Oviposition began during the first week in October and continued until December. Eggs were deposited on the first year's wood, near the ends of the twigs, in the axils of the leaves.

A list of recent literature bearing on this subject is given.

HARTZELL (F. Z.) & PARROTT (P. J.). **The Cherry Leaf-Beetle.**—*New York Agric. Expt. Sta., Geneva,* Circ. no. 49, 15th April 1916, 3 pp., 2 plates. [Received 6th June 1916.]

This paper describes the same outbreak of *Galerucella cavicollis,* Lec., as that recorded in a paper previously abstracted [see this *Review,* Ser. A, iv, p. 309].

The most suitable control measure is to spray cherry and peach trees as soon as the adults appear, with nicotine sulphate (40 per cent.), ½ pt. in 60–80 U.S. gals. water. For cherry trees, lead arsenate solution (8 lb. paste to 100 U.S. gals. water or Bordeaux mixture), or arsenate of lime (6 lb. paste to 100 U.S. gals. water) may be used. Shaking the beetles from the trees into sheets is recommended when the infestation is serious.

TUCKER (E. S.). **Regulatory Work performed in Enforcement of the Fruit and Crop Pest-Laws of Louisiana.**—*17th Biennial Rept. Commissioner Agric. Immigration for 1914 and 1915, Baton Rouge, Louisiana,* 1916, pp. 12–16. [Received 5th June 1916.]

The duties of the Entomologist during 1915 included the inspection of nurseries, etc., the distribution of information concerning, and the identification of, injurious insects, the control and prevention of crop pests and the regulation of the sales and shipments of nursery stock. Owing to the exhaustion of funds, adequate measures could not be taken against citrus canker and consequently the disease spread rapidly. The cottony cushion scale [*Icerya purchasi*] was abundant in and near New Orleans and prohibited the planting of many shade and ornamental trees. Demonstration sprayings against this and other insects were conducted on several occasions.

GLOYER (W. O.) & FULTON (B. B.). **Tree Crickets as Carriers of *Leptosphaeria coniothyrium*, (Fckl.) Sacc., and other Fungi.**—*New York Agric. Expt. Sta., Geneva*, Tech. Bull. no. 50, March 1916, 22 pp., 2 tables, 4 plates. [Received 6th June 1916.]

This paper describes further experiments carried out with the object of determining the part played by *Oecanthus* spp. in spreading canker among fruit trees. Previous records assert that these insects carry the spores of *Leptosphaeria coniothyrium*, and suggest that spores of other fungi may also be distributed in this way. Cankers caused by *L. coniothyrium* are similar in their early stages to those due to *Bacillus amylovorus*, *Sphaeropsis malorum* or *Glomerella cingulata*, but are readily distinguishable at a later period. *L. coniothyrium* cankers are always associated with the oviposition punctures of tree-crickets, and show rapid increase in size just before the flowering period. Periods of activity on the part of the fungus alternate with periods of quiescence. The host endeavours to protect itself by the formation of a callus between the healthy and diseased tissue. The callus may exhibit irregularities and is apparently stimulated to further growth by the presence of woolly aphis [*Eriosoma lanigerum*], which shelter there. Fungus spores are present in large numbers beneath and on the surface of the bark of cankers which are two or more years old. *Sphaeropsis malorum*, *Valsa leucostoma* and certain saprophytes may also be present. Young trees of *Ulmus americana*, growing among tall weeds, may show superficial cankers due to *L. coniothyrium* and with this fungus may be associated *Pestalozzia insidiens*.

Spores of *L. coniothyrium* may be introduced into oviposition punctures in the following ways:—(1) with excrement or vegetable tissue used in plugging the punctures; (2) with the ovipositor; (3) by being washed in by rain.

Experiments were made to determine the effect on the fungus spores of passage through the alimentary canal of tree-crickets. Excrement obtained from insects kept in captivity and from the vicinity of oviposition punctures showed the spores of several kinds of fungi (*Sphaeropsis malorum*, *L. coniothyrium*, *Mucor*, *Puccinia*, etc.). Bacteria, yeasts, and spores of the Protozoan, *Gregarina*. Many of the spores germinated when placed under suitable conditions. In the case of *L. coniothyrium* and *Nummularia discreta*, germination is much more rapid in the presence of apple wood than in water, while both are equally suitable for *S. malorum*. Apple cankers can be artificially produced from spores obtained from the excrement of *Oecanthus angustipennis* and *O. niveus*. Under the experimental conditions, these two species when fed with pure cultures of *L. coniothyrium* from apple cankers produced a lower percentage of disease than when fed with raspberry leaves infested with the same fungus. The percentage of infection was always greater in cases in which the oviposition punctures were closed with grafting wax.

HASEMAN (L.). *Ornix geminatella*, **the Unspotted Tentiform Leaf Miner of Apple.**—*Jl. Agric. Research. Washington, D.C.*, vi, no. 8, 22nd May 1916, pp. 289–296, 1 plate.

Parornix (*Ornix*) *geminatella*, Pack., has been recorded from New England, Colorado, Kentucky, Michigan, Illinois and Ohio. The

observations described in this paper were carried out in Missouri, where the insect appears to be gradually becoming more abundant. *Malus sylvestris* at a mature stage is chiefly attacked, though nursery stock may sometimes be injured. Periods of abundance appear to alternate with periods of scarcity *O. geminatella* is a leaf-mining form. Larvae hatching from eggs deposited on the lower leaf surface at once enter the tissue, where they remain for about two weeks and form a characteristic tentiform type of mine. Pupation occurs in a cocoon formed on the upper surface or at the tip of the leaf. The pupal period varies from a few days to a week in midsummer. Hibernation takes place in the pupal stage in a cocoon protected by a folded edge of a leaf. Adults appear in May and the life-cycle is completed in four or five weeks; a new brood occurs each month until November. The food-plants include the apple, crab-apple, *Crataegus* spp. (hawthorn), plum, cherry, pear and wild cherry.

O. geminatella does not become abundant until late summer and autumn, when the trees have matured; control measures are thus only necessary when the numbers are excessive and likely to be injurious during the next season. In large orchards the best method is to turn under fallen leaves bearing cocoons by means of a disk used in shallow cultivation in early spring. In small areas, the leaves may be raked together and destroyed by burning or covered with soil or stable manure. The insect is controlled to a considerable degree by parasites, of which the following Chalcidoids have been identified:—*Sympiesis nigrifemora*, Ashm., *S. tischerae*, Ashm., *S. meteori*, Gir., *S. dolichogaster*, Ashm., and *Eulophus lineaticoxa*, Gir.

CORY (E. N.). **Notes on Insect Control.**—*Maryland Expt. Sta., College Park*, n.d., 4 pp. [Received 8th June 1916.]

Lead arsenate can be obtained commercially in either the acid or basic form. The acid compound when combined with lime-sulphur reduces the lime content of the latter and causes the precipitation of free sulphur. It has, however, more rapid insecticidal powers than the basic salt. It is thus recommended for use by growers of truck crops, without admixture with lime-sulphur. The basic salt with lime-sulphur should be used by fruit-growers. Sodium sulphides should not be used in combination with lead arsenate as a foliage spray; barium sulphides on the other hand may be safely combined. Tobacco extract should be used against Aphids on orchard trees, melons and peas. In orchards the spray should be used at the rate of ¾ U.S. pt. Black Leaf 40 to 100 U.S. gals. water, to which ⅜ lb. soap has been added. Against pea aphis [*Acyrthosiphon pisi*] and melon aphis [*Aphis gossypii*], the spray should consist of 10 ozs. Black Leaf 40, 50 U.S. gals. water and 4 lb. fish oil soap. Against the rose beetle, the following spray is recommended:—4 lb. lead arsenate, 100 U.S. gals. Bordeaux mixture and 1 U.S. gal. molasses.

JARVIS (E.). **Combating the Cane Beetle.**—*Queensland Agric. Jl., Brisbane*, v, no. 5, May 1916, pp. 280–281.

Experiments conducted to observe the effect of certain chemicals on the larvae of the cane beetle [*Lepidiota*] yielded the following results: (1) Creolin (1 pt. to 50 gals. water) destroyed 100 per cent. of the larvae

in soil in the laboratory, without injury to the roots of a sugar-cane. The high price of this substance renders its use on a large scale impracticable. (2) Potassium cyanide (½ lb. to 200 gals. water) was fatal to 100 per cent. of larvae under the same conditions as in the previous experiment. A plant 2 feet high treated with 8 qts. of the solution showed a slight wilting of the leaves after 24 hours, but recovered a week later. The Mamelle method of injecting potassium cyanide received preliminary tests and gave satisfactory results. (3) Borax (1 lb. to 3 gals. water) proved efficient, but was too expensive for extensive use. (4) Creosote emulsion (8 oz. creosote to 5 gals. water) proved suitable. Solutions of saltpetre (1 lb. to 3 gals.), barium chloride (1 lb. to 3 gals.) and hellebore (1 lb. to 12 gals.) gave negative results. The last-named substance had been in stock for about a year and may in consequence have lost its insecticidal properties.

JARVIS (E.). **Notes on Insects Damaging Sugar-Cane in Queensland.**—*Queensland Bureau of Sugar Expt. Sta., Div., Entom., Brisbane*, Bull. no. 3, 1916, 48 pp., 4 plates. [Received 14th June 1916.]

Insect pests of sugar-cane in Queensland include those attacking (1) the stalk and mid-rib of the leaf; (2) the stalk and "sets" below ground; (3) the foliage; (4) the roots; and (5) those feeding on the sap. In the first group, the Noctuid, *Phragmatiphila truncata*, Walk., occurs also in South Australia and Tasmania, and is chiefly injurious to young shoots in September and October. Pupation takes place in the tunnels or among the bases of dead canes or leaf-sheaths. The duration of this stage in November is 12 days at a temperature of 77° F. Small holes bored through affected stems by the larvae allow of the entrance of predaceous enemies, especially the ant, *Pheidole megacephala*. The latter would probably prove an effective controlling agent, but should not be encouraged in fields in which *Rhabdocnemis obscurus* is present, since it destroys the Dipterous parasites of this insect. Larvae of *P. truncata* are parasitised by an undetermined Tachinid fly and in New South Wales by the Hymenopteron, *Apanteles nonagriae*; the pupa is parasitised by *Euplectus howardi*. *Diatraea saccharalis*, F., is controlled to a great extent by egg-parasites and cannot be regarded as a serious pest. *Rhabdocnemis obscurus*, Boisd., causes considerable annual loss in the Johnstone River district. The Tachinid parasite, *Ceromasia sphenophori*, Vill., has been liberated in affected localities. Artificial methods of control include clean cultivation and the use of short pieces of split cane as traps. A Pyralid, *Polychroa* sp., was recorded for the first time in November 1915 at Pyramid, where young ratoon shoots were injured. Pupation was observed to take place in the tunnel in the middle of the shoot. In the laboratory this stage lasted from 22nd November until 12th December. The Tineid, *Opogona glycyphaga*, Meyr., may prove injurious to soft varieties of cane by boring into the stem and feeding on the leaf-sheaths. The leaf-stalks of banana and the fruits of granadilla may also be attacked by the larvae. Pupation takes place in a cocoon formed between the sheath and the stem [see this *Review*, Ser. A, iii, p. 364]. A Chalcid parasite, *Stomatoceras gracilicorpus*, Gir., has been reared from the pupa. The Elachistid, *Cosmopteryx* sp., bores

in the larval stage into the mid-rib of the leaf, causing the injured tissue to turn red and in some cases the leaf-blade to wither prematurely. A related species, *C. pallifasciella*, attacks sugar-cane in Java.

Four insects are known to attack the cane-stalk below ground; these are the Dynastid, *Heteronychus* sp., the Scarabaeid, *Pentodon australis*, Blackb., the Elaterid, *Monocrepidius* sp., and *Termes meridionalis*.

A large number of insects feed on the foliage. *Locusta danica*, L., has been reported from western and northern Queensland. Egg parasites of this species occurring in Australia are *Scelio australis*, Frogg., and *S. ovi*, Gir. *Sarcophaga aurifrons*, Coq., has been reared from the adult, and several undetermined Dipterous larvae have emerged from adults taken at Gordonvale. *L. australis*, Brunn., occurs in the coastal districts of Queensland and New South Wales. Other members of the family ACRIDIIDAE occasionally of importance are *Atractomorpha crenaticeps*, Blanch., *Oxya velox*, F., *Cyrtacanthacris* ? *proxima*, Walk., *C. plagiata*, Walk., and *C. guttulosa*, Walk. The Noctuid moth, *Cirphis unipuncta*, Haw., may be present in destructive numbers, but is normally controlled by birds and parasitic Hymenoptera and Diptera. The Hesperid, *Parnara mathias*, F., feeds in the larval stage within the folded leaves. The pupal stage occupies about 11 days at a shade temperature of 81° F. A Braconid parasite has been reared from the larva. Other Hesperids similar in habit to the preceding species are *Telicota augiaskreffti*, Macl., and *Padraona marnas*, Feld. Additional species attacking the foliage are the Noctuid, *Chusaris rhodias*, Turn., the Tortricid, *Harmologa* ? *miserana*, Walk., *Euproctis holoxutha*, Turn., and the Chrysomelids, *Rhyparida morosa*, Jac., *Rhyparida* sp. (*basipennis* var. ?), *R. didyma*, F., and *Colasposoma sellatum*, Baly. The first-named beetle occurs on the native plant, *Imperata arundinacea*, and the last two on *Commersonia echinata* and *Sorghum halepense* respectively. The weevil, *Stenocorynus aridus*, Pasc., feeds normally on *Urena lobata*, but may attack the leaves of sugar-cane.

Sap-sucking insects include:—*Tettigonia parthaon*, Kirk.; *Perkinsiella saccharicida*, Kirk.; *Aphis sacchari*, Zehn., occurring on the underside of the leaves in the hot season; *A. adusta*, Zehn., a bud aphis, found at the base of the shoots or on the buds in late winter and early spring; *Aleurodes berghi*, Sign., *Pseudococcus* ? *calceolariae*, Mask., and *Ripersia* sp.

The most important insect attacking the roots of sugar-cane is *Lepidiota albohirta*, Waterh. The natural enemies include the digger wasps, *Dielis formosus*, Guér., *Campsomeris radula*, F., and *Discolia soror*, Sm., parasitic Tachinids and Muscids and the predaceous larvae of the Elaterid, *Agrypnus mastersi*. *L. frenchi*, Blackb., often occurs in cane fields situated near forest land. *L. rothei*, Blackb., and *L. caudata*, Blackb., may occasionally be present in injurious numbers. The Scarabaeid, *Dasygnathus australis dejeani*, Macl., is usually abundant and is widely distributed; it is parasitised by an undetermined Dexiid fly. *Anoplognathus boisduvali*, Boisd., is an important pest of cane in sandy soil and is widely distributed in north and south Queensland. The adult is readily attracted by artificial light. The Rutelid, *Anomala antiqua*, Gyl. (*australasiae*, Blackb.), may be abundant. The natural enemies include undetermined parasitic

Tachinid and Dexiid flies. Other beetles of less importance attacking the roots are *Lepidiota froggatti*, Macl., *Xylotrupes gideon*, L. (*australicus*, Thomp.), *Isodon puncticollis*, Macl., and *Cacochroa decorticata*, Macl.

GLASGOW (R. D.). *Phyllophaga*, **Harris** (*Lachnosterna*, **Hope**): **a Revision of the Synonymy, and one New Name.**—*Bull. Illinois State Lab. Nat. Hist., Urbana*, xi, art. 5, February 1916, pp. 365-379. [Received 13th June 1916.]

The name *Phyllophaga*, proposed by T. W. Harris in 1826, is adopted by the author on the ground that its validity was fully established by its publication in connection with a series of valid specific names, viz., *quercina, hirsuta, hirticula, balia*, etc. In the absence of a designated genotype, the species *hirticula*, Knoch, is proposed as the type of the genus. The name *Lachnosterna*, used both by English and American entomologists, was not put forward by Hope until 1837. A list of North American species of this genus, with their synonyms, is given, together with a bibliography containing the names of 32 papers giving original descriptions of the species occurring in the United States and Canada.

A new species which is abundant in southern Illinois in June, July, and August is described under the name *P. forbesi*.

STRICKLAND (E. H.). **The Control of Cutworms in the Prairie Provinces.**—*Dominion of Canada Dept. Agric., Entom. Branch, Ottawa*, Circ. no. 6, 1916, 8 pp., 5 figs. [Received 14th June 1916.]

The most important species of cutworms occurring in the Prairie Provinces are *Euxoa ochrogaster* (red-backed cutworm) and *Porosagrotis orthogonia* (pale western cutworm), while *Euxoa* (*Chorizagrotis*) *auxiliaris* (army cutworm) is found in restricted areas. The eggs of the first two species are deposited in August and September below or on the surface of summer fallow land which has become broken and partly covered with weeds. A few larvae hatch out in autumn, feed for a short time, then enter the ground to hibernate. The majority of larvae emerge in the following April. Owing to the dry nature of the soil, the larvae are able to move freely below the surface and feed almost entirely in this position on the stems of weeds and crops. Pupation takes place in earthen cells during June, and adults appear about a month later. Control measures are based to a large extent on methods of cultivation. Fallow land should be kept free from weeds during the oviposition period, i.e., from 1st August to 20th September, and should be worked as finely as possible. If this measure is not carried out, deep autumn ploughing should be performed. Autumn wheat should not be sown earlier than the second week in September. A poisoned bait consisting of 50 lb. shorts, 1 lb. Paris green, 1 gal. molasses and 1½ gals. water may be scattered during April or May among crops which have been planted on fallow land. Where the soil is dry, the land should be harrowed after application. Measures of control which are not suitable for prairie conditions are the use of light traps, the application of lime and salt and the burning of stubble in autumn.

Gibson (A.) & Treherne (R. C.). **The Cabbage Root Maggot and its Control in Canada, with Notes on the Imported Onion Maggot and the Seed-corn Maggot.**—*Dominion of Canada Dept. Agric., Entom. Branch, Ottawa,* Bull. no. 12, 1916, 58 pp., 29 figs., 10 tables, 1 chart. [Received 14th June 1916.]

Chortophila (Phorbia) brassicae, Bch. (cabbage root maggot) occurs throughout Canada, attacking cabbage, turnip, cauliflower and other Cruciferous plants. Eggs laid on or near the base of the host plant hatched, in 1915, in from three to five days under outdoor conditions, the degree of fertility being 86·9 per cent. When incubated at temperatures between 80° and 85° F., 95 per cent. hatched in from three to five days under moist conditions and 50 per cent. in the same time in dry air. The duration of the larval stage varied from 19 to 32 days. Pupation takes place in the root tissues, or in the soil close to the root or at a distance of 4 or 5 inches away. Overwintering pupae were found at a depth of from 1 to 9 inches. The duration of the pupal stage varies very considerably according to the temperature. At Agassiz, B.C., where the average temperature for March was 41° F., adults emerged from overwintering pupae on 8th April; in Ottawa, where the average temperature was 19·3° F., pupae collected on 25th April transformed between 20th May and 6th July. The average length of the adult stage was 3·5 days at the end of June and nine days at the end of August and during September, the variations shown ranging between 2 and 5 days and 7 and 25 days at these periods. The sexes were present throughout the season in practically equal numbers.

At Agassiz, in 1915, oviposition was first observed on 10th April and continued until about 1st June. Adults from the earliest eggs appeared at the end of May, while those from eggs deposited late did not emerge until the beginning of July. In eastern Canada, flies of the first generation emerged from 21st to 27th June. The first eggs of the second and third generations appeared at Agassiz during the first week in June and the end of July respectively. A complete or partial fourth generation may occur, according to autumn conditions; at Agassiz egg-laying continued until 22nd October. *C. brassicae* has thus at least three complete generations which show much overlapping, so that all stages of development occur at any given time. In the Ottawa district injury to cabbage and cauliflower plants is most marked during May and June. Radish crops grown at Agassiz during May are frequently severely damaged. It is probable that no varieties of cabbage or cauliflower are immune to attack. Observations on the oviposition habits showed that the majority of eggs are deposited on the stem or in the crevice between the stem and the soil. Untreated cabbage and cauliflower plants which died as the result of attack reached a total of 12·1 and 11·4 per cent. respectively. Eggs were apparently laid more freely on or near strong, long-stemmed plants. The preoviposition period under insectary conditions during July was about six days. The winter is passed in the pupal stage.

Hylemyia antiqua, Mg. (imported onion maggot) is a pest of onions throughout Canada. The eggs are deposited on the young leaves, on the outside of the stem near the soil or on the soil itself. During 1915 the first eggs were observed at Ottawa on 4th June. The eggs hatch

in less than a week, and the larvae at once enter the growing bulb, where they feed at the lower end. The duration of the larval stage is from two to three weeks, but in seeded onions from the previous year may last four or five weeks [see this *Review*, Ser. A, iii, p. 569]. Pupation takes place in the soil at a depth of from ½ to 3 inches, or in the outer layers of the onion bulb. The duration of this stage in eastern Canada is about 14 days and in British Columbia varies from 14 to 26 days in midsummer. There are probably about three generations each year. The winter is passed in the pupal stage; adults were first observed at Ottawa in the third week in May. The preoviposition period varies from 10 to 14 days.

Injury to beans, peas and maize caused by *Chortophila* (*Phorbia*) *fusciceps*, Zett. (corn-seed maggot) has been recorded from Ontario, Quebec, and the maritime provinces. The eggs are probably laid in the soil in which the seeds of the above plants are present and the larvae attack the plants soon after germination. The cotyledons and later the young stem are injured by the burrowing habit of the larva. Turnips, cabbage, onions, etc., and also the eggs of locusts may be attacked. Pupation of larvae collected on 23rd June took place on the following day close below the surface of the soil; the first adult emerged on 2nd July and the last on 9th July. Later generations, the number of which is unknown, probably attack plants other than peas, beans or maize. In the United States the insect probably hibernates in the adult stage.

Experiments on the control of the root-maggots described above have shown that tarred felt paper discs placed around the plant as soon as possible after setting out are most effective. Frames made of cheesecloth are also useful for protecting seedlings, and this measure may be supplemented by the growth of a trap crop of radishes. The success of autumn planting of cabbages and cauliflowers depends largely on the weather conditions in the following spring; favourable conditions for the development of the larvae would lead to a heavy infestation of such crops. Two or three applications of white hellebore or pyrethrum powder in a dry or liquid form afford a considerable degree of protection. Carbolic emulsion has also proved satisfactory. This is prepared according to the formula :—1 qt. soft soap, 1 pt. crude carbolic acid, 1 gal. water; the stock solution is diluted 35 times before use. Turnip and other seed should be sown thickly, since the eggs are then more scattered. The use of hellebore, etc., against the onion maggot is not practicable under field conditions, but the adults can be attracted during the pre-oviposition period by a sweetened arsenical spray [see this *Review*, Ser. A, iii, p. 570]. Carbolic emulsion is probably of no value against *C. fusciceps* in peas and beans; the seeds should not be planted more than 1 or 2 inches deep and in well prepared soil. Crop rotation should be practised. Seedlings should be transplanted with a quantity of soil round the roots to prevent, as far as possible, the burrowing of the larvae into the stems. Deep ploughing in the autumn destroys numerous pupae in the soil, but where crops are cultivated through the winter, infested plants should be removed and destroyed.

The following parasites have been reared in Canada from *C. brassicae*: *Baryodma ontarionis*, Casey, *Cothonaspis gilletti*, Wash., *Pachycrepoideus dubius*, Ashm., and the Ichneumon, *Hemiteles ruficoxus*, Prov.

Predaceous Carabid and Staphilinid beetles attacking the same species include *Bembidium mutatum*, G. and H., *B. trechiforme*, Lec., *Platynus cupreus*, Dej., *Pterostichus lucublaudus*, Say, *Orus punctatus*, Casey, *Xantholinus hamatus*, Say, *Hesperobium californicum*, Lec., and *Dinaroea angustula*, Gyll. The mite, *Trombidium scabrum* has been reported to attack the eggs of *C. brassicae* in Minnesota.

TAVARES (J. S.) **Espécies e Variedades novas de Cynípides e Cecidomyias da Peninsula Ibérica e descripção de algumas já conhecidsa.** [New species and varieties of Cynipidae and Cecidomyidae from the Iberian Peninsula with a description of some known ones.]—*Broteria, Braga*, xiv, no. 2, 1st June 1916, pp. 65–136, 17 figs.

The contents of this systematic paper are described in its title.

MOLINA (E.). **Los Naranjos de Catamarca: Males que aquejan su producción.** [The oranges of Catamarca and the ills which affect their production.]—*Boletin Minist. Agric., Buenos Aires*, xx, nos. 1–2, January–February 1916, pp. 46–51. [Received 10th June 1916.]

The following scale-insects are among the pests attacking oranges in the Argentine province of Catamarca lying east of the Andes:—*Chrysomphalus aonidum*, *Aspidiotus hederae*, *Lepidosaphes beckii* (*Mytilaspis citricola*), *Coccus* (*Lecanium*) *hesperidum*, and *Saissetia* (*L.*) *oleae*. They seem to have made their first appearance in 1906 and since then have increased enormously. A spray containing 60 lb. of flour, 3 gals. of kerosene, and 97 gals. of water is stated to have been very effective [see this *Review*, Ser. A, iv, p. 18].

CANELA (P. T.). **El grano picado en los trigos santafecinos de la cosecha 1914-15.** [Insect-bored grain in wheat of the 1914-15 crop in the province of Santa Fe.]—*Boletin Minist. Agric., Buenos Aires*, xx, nos. 1-2, January-February 1916, pp. 103-116, 1 fig. 1 map. [Received 10th June 1916.]

This paper describes the infestation of wheat by *Sitotroga cerealella*, Hol. A description of this pest is given and the attack is believed to be due to the numerous centres of infestation provided by stacks of maize in the cob. Owing to low prices the maize was left in the cob for a considerable period and at nightfall the moths were observed in the neighbourhood of the stacks. Although the damage done has not yet become important, preventive measures are advised against this dangerous pest.

CARUSO (G.). **Sull' efficacia comparativa della Poltiglia bordolese e della Pasta Caffaro.** [The comparative efficiency of Bordeaux mixture and of Pasta Caffaro.]—*Minerva Agraria, Milan*, viii (ii of Series 2), nos. 9-10, 15th-30th May 1916, pp. 116-117. [Abstract from *Atti della R. Accademia dei Georgofili*, 5th March 1916, and from *L'Agricoltura Italiana*, nos. 1-3, 1916.]

In experiments on the comparative value of various fungicides it was found that the growing parts of the vine were better protected against the attacks of *Peronospora* by lime-copper sprays of from 5 to 10

per thousand strength than by Pasta Caffaro of from 10 to 15 per thousand. Both products appeared to have about the same adhesive power. The following results were obtained with 100 bunches in each of four groups of vines treated with the above four solutions:—Lime-copper spray of 5 per thousand—43·36 healthy bunches, 35·64 partly injured bunches, 21·0 totally destroyed bunches. Lime-copper spray of 10 per thousand—59·44 healthy bunches, 30·07 partly injured bunches, 10·49 totally destroyed bunches. Pasta Caffaro of 10 per thousand—33·0 healthy bunches, 44·62 partly injured bunches, 22·38 totally destroyed bunches. Pasta Caffaro of 15 per thousand—31·27 healthy bunches, 46·42 partly injured bunches, 22·31 totally destroyed bunches. There is therefore no reason for abandoning lime-copper treatment.

Beech bark infested by *Cryptococcus fagi*, **Bär.**—*Jl. d'Agric. Pratique, Paris*, xxix, N.S. no. 11, 1st June, 1916, p. 202.

It is stated that *Cryptococcus fagi*, Bär., is only known on the beech to which it does considerable damage in England. The trunks should be brushed with a long-haired brush dipped in a solution of 1 oz. black soap in 20 oz. water; it is also necessary to uncover the upper portion of the main roots and to treat them in the same manner.

KADOCSA (Gy.). *Crioceris melanopa* (*Lema melanopus*) **injurious to Oats and Barley in Hungary.**—*Internat. Review Science and Practice of Agric.* (Mthly. Bull. Agric. Intelligence and Plant Diseases), *Rome*, vii, no. 2, February 1916, pp. 312–314. [Abstract fom *Kisérletugyi Közlemények, Budapest*, xviii, no. 1, pp. 108–176, 8 plates.] [Received 12th June 1916.]

Since 1831 *Lema* (*Crioceris*) *melanopa*, L., has frequently been the cause of serious damage in Hungary. The worst ravages were caused in 1891, when 23 districts were affected, the damage being estimated at between 1 and 1¼ million sterling. Extract of pyrethrum, "thanaton," and arsenate of copper were tested. The last-named insecticide gave negative results. The extract of pyrethrum (2½ per cent.), applied in large quantities, killed 75 per cent. of the larvae, but its high price did not allow of its being used on too extensive areas. "Thanaton," on the contrary, gave excellent results in a 2 per cent. aqueous solution when its percentage of nicotine was not too much below 4½ per cent. Nicotine sulphate has also proved satisfactory. Both "thanaton" and nicotine sulphate gave the best results when the nicotine content was from 0·4 to 0·5 oz. per gallon of water. A 4 per cent. solution of barium chloride, rendered adhesive by the addition of 4 per cent. of molasses, was less satisfactory. The life-cycle of *L. melanopa* is described and its natural enemies are enumerated, together with the preventive means employed hitherto. Although in Hungary this insect inhabits the plains, it may also be found in mountainous regions where the climate and soil are favourable to the cultivation of barley and oats. Its appearance in swarms is periodical. Through a succession of years the infested zones become increasingly extensive and the damage reaches a maximum, after which it diminishes, probably owing to natural enemies. *L. melanopa* is known also in

other countries, but is seems to be only really dangerous to agriculture in Austria, Rumania, and especially Russia. Under normal conditions the first insects appear at the beginning of April and there is only one generation a year. *L. cyanella*, L. (*lichenis*, Voet.) is also known in Hungary as an injurious insect, but is less common.

SCHURMANN (G.). *Pulvinaria vitis* **in Uruguay.**—*Internat. Review Science and Practice Agric.* (Mthly. Bull. Agric. Intelligence and Plant Diseases), *Rome*, vii, no. 2, February 1916, p. 317. [Abstract from *Rev. Asociación Rural del Uruguay, Montevideo*, xliv, no. 8, pp. 481–483, 1 fig.] [Received 12th June 1916.]

The appearance of *Pulvinaria vitis* in Uruguay in November 1914 is reported—it is believed for the first time. Serious damage was done in the vineyards. Information is given on the morphology and biology of this scale and on the usual methods of control.

SERGENT (Et.). **Campagne d'expérimentation de la méthode biologique contre les *Schistocerca peregrina*, dans la vallée de la Haute Tafna, commune mixte de Sebdou (département d'Oran). Existence d'une épizootie autochtone vaccinante (mai, juin, juillet 1915).** [An experimental campaign with the biological method against *Schistocerca peregrina* in the valley of the Upper Tafna, mixed commune of Sebdou (department of Oran). The existence of a natural infection which produced immunity (May, June, July 1915).]—*Ann. Inst. Pasteur, Paris*, xxx, no. 5, May 1916, pp. 209–224, 10 figs.

This paper is a detailed account of the author's work in the district under his charge in the anti-locust campaign in 1915. The main facts and conclusions obtained in the campaign have been dealt with in a joint report [see this *Review*, Ser. A, iv, p. 45]. All the birds in the region preyed upon the locusts. In May numerous pupae of *Anthomyia* were noticed, other parasites being the larvae of *Cebrio* and *Anthrax fenestrata*. In June, pupae of *Stomatorrhina* (*Idia*) *fasciata*, larvae and adults of Staphylinids, and Oligochaetes, were all present in numbers. In the Sebdou region the infection was not fatal to *Schistocerca peregrina*; this failure is thought to be due to the presence of an indigenous infection, caused by two distinct bacteria of the same group as d'Hérelle's virus, which apparently rendered the insects immune to the American form.

BÉGUET (M.). **Campagne d'expérimentation de la méthode biologique contre les *Schistocerca peregrina*, en Algérie, de décembre 1914 à juillet 1915, et en particulier dans la région de Barika (département de Constantine).** [An experimental campaign with the biological method against *Schistocerca peregrina* in Algeria from December 1914 to July 1915, and more particularly in the Barika region (department of Constantine).]—*Ann. Inst. Pasteur, Paris*, xxx, no. 5, May 1916, pp. 225–242, 1 sketch map.

This is a detailed account of the author's work in the district allotted to him in the anti-locust campaign in Algeria in 1915 [see above].

ROEPKE (W.). **Ueber einige weniger bekannte, kulturschädliche Lepidopteren auf Java.** [On some little known Lepidopterous pests of crops in Java.]—*Tijdschrift voor Entomologie, The Hague,* lix, pts. 1 & 2, dated 1st June 1916, pp. 1–17, 6 plates, 3 figs.

The caterpillars of the recently described *Mudaria variabilis*, Rpk., [see this *Review*, Ser. A, iv, p. 88] are in certain years only too well known to the planters on the ripening fruits of kapok, the fibre of which is partly destroyed or rendered valueless. In 1914, 30 per cent. of the pods were attacked, and there appears to be some relation between large outbreaks and exceptional drought during the East Monsoon from May to October. Nothing is known of the earlier stages of this pest. The development of the caterpillars is completed in the still green, but ripening kapok pods, and the undeveloped silk hairs and the unripe seeds are consumed. Even when the pods are apparently not greatly damaged, their remaining content is of very poor quality and stained brown by excrement; woodpeckers that are in search of the caterpillars often complete the destruction of the pod. The author has also found the caterpillars on two wild species, viz:—*Bombax malabarica* and *B. valetonii*. Before pupation a circular hole about one-sixth of an inch in diameter is bored through the shell of the pod. The caterpillars rapidly burrowed in damp earth provided for the purpose in order to pupate between the end of October and the middle of November. At the end of the following May, when the kapok was in flower, emergence was expected, but the first imago did not appear until the middle of August and the bulk of the remainder during September. From nine pupae which were thought to be dead, but were really in a condition to hibernate again, the moths emerged in the course of the following January, probably prematurely, owing to their having been kept too dry. The fully-grown caterpillar, pupa and imago are described and compared with the closely allied *M. cornifrons*, Moore.

Control seems difficult; the destruction of the wild species of *Bombax* is not considered practicable, and as the attacked pods are not readily distinguished from sound ones, nothing can be gained by early collection of them. No natural enemies other than the woodpeckers, which do more harm than good, have been observed.

The next species dealt with, *Arbela tetraonis*, Moore, is markedly polyphagous with a predilection for kapok. The following leguminous shade trees are also largely attacked:—*Albizzia moluccana*, *A. stipulata*, *Deguelia microphylla*, *Caesalpinia dasyrachis*, *Pithecolobium* and others. The caterpillar lives in a rather short burrow inside the stem or twig; this serves more as a resting place than anything else, as the living bark supplies the food. Pupation takes place in the burrow and close behind the outlet. The caterpillars are difficult to rear, the best plan being to enclose an attacked stem in a gauze cage, and it was in this way that the author obtained imagines of this moth. The damage done to kapok and other trees is not very serious and cacao is only occasionally attacked and then chiefly neglected or badly cultivated trees. The caterpillars have been found in Java on *Albizzia moluccana* at a height of 5,000 feet above the sea.

The third pest is a small Noctuid, *Autoba lilacina*, Warren, the caterpillars of which live on cacao and *Cynometra cauliflora*, eating shallow burrows in the rind of the fruit and never penetrating to the

interior; fruits badly attacked by *Pseudococcus crotonis* seem to be preferred. Pupation takes place in a retort-shaped cocoon which is attached to the fruits or to a twig near by. The moth is described and its relationships and synonymy discussed at length; the opinion is expressed that this species may prove to be identical with *Eublemma versicolora*, Walk.

TRÄGÅRDH (Ivar). **Våra vanliga spinnkvalster och deras bekämpande.** [Our most common spinning mites and their control.]—*Centralanstalten för Försöksväsendet på Jordbruksområdet, Stockholm*, Flygblad no. 58. Entomol. Avd. no. 13, March 1916, 4 pp., 3 text-figs. [Received 26th June 1916.]

This is a short popular summary of the investigations published earlier by the author [see this *Review*, Ser. A, Vol. iii, p. 252].

It deals with the following species:—The fruit tree spinning mite, *Paratetranychus pilosus*, C. and F.; the pine-tree spinning mite, *Paratetranychus ununguis*, Jac.; the hothouse spinning mite, *Tetranychus althaeae*, v. Hanst., and the common spinning mite, *Tetranychus telarius*, L. The measures of control recommended are:—Winter spraying against the eggs of *P. pilosus*, of *P. ununguis* on larch and the hibernating females of *T. telarius*. Summer spraying with lime-sulphur against *T. althaeae* in hot-houses and hot-beds (21° Bé), one part to 40 parts of water with the addition of gelatine (10–16 grammes to 100 litre water). Frequent spraying of the plants with water is also very useful in hot-houses, as well as spraying with quassia or nicotine.

TULLGREN (Alb.). **Rosentriten och en ny äggparasit på densamma.** [*Typhlocyba rosae*, L., and a new egg-parasite of the same.] —*Meddelande* no. 132, *Centralanstalten för Försöksväsendet på Jordbruksområdet, Stockholm*, Entomol. Avd. no. 24, 1916, 13 pages, 7 text-figs.

Typhlocyba rosae is widely distributed in Sweden and apparently occurs wherever its native food-plant, the wild briar, is found. It is a well known pest of roses, but otherwise the author has found it only on apple-trees and is inclined to believe that statements of its occurrence on other plants are due to mistakes in identification. Oviposition takes place in the autumn in pockets in the bark, and the eggs hatch in the spring. In Sweden there is probably only one generation a year. If rose-bushes have been severely injured, the branches most heavily infested with eggs must be removed. The leaf-hoppers and their nymphs are easily killed with various contact sprays, and the effect of this treatment is the more pronounced the younger the larvae are, because later the leaves become curled and provide effective protection for the insects; the adults are also very active and escape the spraying. Nicotine and quassia are especially effective. The eggs are parasitised by a Mymarid, *Anagrus bartheli*, sp. n., a detailed description of which is given, accompanied by figures.

KEMNER (N. A.). **Några nya eller mindre kända skadedjur på frukkträd, jamte en biologisk översikt av fruktträdens gren- och stamskador.** [Some new or little known enemies of fruit trees, with a summary of the life-history of those which attack the trunk and the branches.]—*Meddelande* no. 133, *Centralanstalten för Försöksväsendet på Jordbruksområdet, Stockholm,* Entomol. Avdln, no. 25, 1916, 21 pages, 11 text-figs.

Scolytus rugulosus, Ratz., has been found in mountain ash in the vicinity of Experimentalfältet, having been previously recorded only from the south of Sweden, Scania and Öland. Subsequently branches of apple injured by this beetle were sent from the neighbourhood of Nyköping and it is therefore concluded that this insect is now extending its distribution northwards. The beetle and the larva are described in detail and figured. It chiefly attacks fruit-trees, such as apple, pear, plum and cherry, as well as peaches and apricots in the U.S.A. Other host-plants are bird-cherry, black-thorn, *Amelanchier*, *Cydonia*, *Crataegus*, mountain-ash, etc. This beetle oviposits in the smaller branches avoiding the trunk and larger branches, in contradistinction to the closely related *Scolytus pruni*, which specially attacks the latter parts of the tree. The number of generations during a year is not known, but the author is of opinion that there is only one. The damage, natural enemies and measures of control are discussed, but no original observations are given.

Magdalis pruni, L. (*ruficornis*, L.) occurs in company with *S. rugulosus*, but is rare, although found throughout the country. It attacks the common fruit trees, as well as apricots and peaches, and in exceptional cases bird-cherry, black-thorn and roses. The attack begins in the spring, when the beetles damage the leaves. The eggs are deposited in crevices on the branches and the young larvae make galleries between the bark and the wood, ending in pupal chambers deeper than the galleries. *Anobium rufipes*, F., was found in the decayed part of the trunk of an old cherry-tree at Experimentalfältet, which was completely perforated by the galleries of the larvae, a detailed description of which is given. The imagines swarm in July onwards in warm weather, oviposition taking place on the bark. The larval galleries are very irregular and are completely filled by a mass of densely packed excrement. The beetle attacks chestnut, hazel, beach, walnut, and alder, as well as fruit-trees. It is attacked by a Braconid, *Hecabolus sulcatus*, Curt. To control it the attacked part of the trunk must be cut out and the surface covered with tar. A useful key to the insects attacking the branches and trunk of fruit trees, according to the nature of the injury, is appended to this paper.

KEMNER (N. A.). *Otiorrhynchus sulcatus*, **F., ett skadedjur bland annat pa krukväxter.** [*Otiorrhynchus sulcatus*, F., an enemy of pot plants.]—*Trädgården, Stockholm,* no. 18, 10th May 1916, p. 145, 2 figs.

The larva of this weevil is often introduced into pots with soil from infected hot-houses, and instances are known when as many as 20 larvae have been found in one pot. In the open the adults appear in the spring but in hot-houses they also occur at other times of the

year. They damage the leaves of various plants and especially ferns, rhododendrons, orchids, etc. In the open they are also found on strawberries and raspberries. The damage done by the larva, which attacks the roots, is much more serious and is very often overlooked, the plants dying by degrees over a long period. Infested plants should be repotted or the larvae may be killed by placing the pots in water for some time. In the open the beetles must be carefully collected during the night by means of lamps.

TULLGREN (Alb.). **Skadedjur på hallonbuskar.** [Enemies of raspberries.]—*Trädgården*, no. 20, 17th May 1916, *Stockholm*, pp. 158–159.

Generally speaking raspberries in Sweden do not suffer much from the attacks of injurious insects. The most important is *Byturus tomentosus*. These beetles appear at the beginning of the summer, shortly before the flower buds are formed. They also feed on the flowers of fruit trees, but are not thought to do any appreciable harm to them. When the buds of the raspberries are big enough, they enter them by a hole pierced in one side, mainly for the purpose of oviposition. The eggs are placed only in comparatively uninjured buds or newly opened flowers, the small larvae afterwards entering the ovaries. The adult beetles do more harm than the larvae, and instances are known when practically the entire crop was destroyed by them. Measures of control must therefore be applied when the raspberries are in flower, the beetles being then collected in suitable nets. Of secondary importance on the raspberries are certain Aphids, which, however, seldom occur in such numbers as to cause serious injury; they are easily controlled by spraying with quassia. Raspberries are sometimes attacked by *Priophorus tristis*, and some years ago this sawfly defoliated several bushes in the vicinity of Stockholm. The larvae are easily controlled by spraying with arsenicals. The shoots are often attacked by *Aegeria* (*Bembecia*) *hylaeiformis* and some gall-midges, such as *Lasioptera rubi*.

TRÄGÅRDH (Ivar). **Jättebarkborren** (*Dendroctonus micans*, **Kug.**). [The giant bark-beetle]—*Skogsvardsföreningens Tidskrift, Stockholm*, no. 5, May 1916, pp. 484–486, 3 figs.

This is a short summary of the bionomics of *Dendroctonus micans*, the only European representative of this genus, which is so well represented in North America. In Sweden it is rare from reasons not understood, although distributed all over the country.

SOMERVILLE (W.). **A Caterpillar on the Ears of Wheat.**—*Jl. Bd. Agric., London*, xxiii, no. 3, June 1916, pp. 236–238, 1 fig.

Hadena basilinea (rustic shoulder-knot moth) was found during August 1915 on wheat grown in experimental plots at Oxford. This species occurs throughout the United Kingdom, in north and central Europe, Asia, east and central United States, and a variety (*finitima*)

in Canada. In the United Kingdom the eggs are laid in June. The larvae, which hatch in about two weeks, feed on grass, or on the ears of wheat, if this is present. Feeding takes place at night; during the day the larvae remain beneath the surface of the soil. In August or September they penetrate more deeply into the ground in order to hibernate. They emerge in the following spring and feed on the leaves and stems of cereals and grasses, pupating in May or June. No appreciable damage by this insect has as yet been recorded in Britain, but as it has been recorded as injurious in Russia, Denmark, Sweden, etc., it is advisable to keep a watch for its presence, so that control measures may be undertaken if necessary.

ROEBUCK (A.). **A Bad Attack by the Mustard Beetle on Watercress.**—*Jl. Bd. Agric., London,* xxiii, no. 3, June 1916, pp. 238-241, 1 plate.

Phaedon cochleariae has for several years caused serious injury to watercress beds in Shropshire. The larvae feed on the leaves and outer layers of the stems of the plants between May and the end of the year, and often cause complete defoliation. The beetles emerge from hibernating places, such as loose bark, hollow stems of weeds, etc., in the vicinity of the beds during the end of April and the beginning of May. Adults from eggs laid by over-wintering females appear about the middle of June, while adults of the second generation appear at the end of July. Pupae occur in holes in the banks above the level of the water and especially round the roots of grasses, and adults are to be found on the aerial portions of the host and in the fields and hedges surrounding the beds. Observations made in 1914 on four series of beds proved that treatment in order to be effective must be made over the whole area. The following control measures are suggested:—(1) When the adults appear in May, the beds should be flooded and stirred constantly. The beetles are thus kept in the water, and since they usually collect at one end, may be drawn off. Rubbish placed round the beds will serve to catch the escaping beetles. The flood water should then be run off and the rubbish destroyed. (2) Flooding should be repeated in June and July, if necessary, to destroy larvae and adults of succeeding generations. Overhanging banks should be cut away in order to expose the pupae to the water; adults may be captured as in the former case. (3) The cutting of hollow-stemmed weeds and grasses, the pruning of hedges and the destruction of refuse from the beds in winter should considerably lessen the numbers of hibernating adults. Wire fencing or tarred palings are preferable to ordinary hedges, since they afford no shelter.

GOUGH (L. H.) & MCKILLOP (A. T.). **Report on the great Invasion of Locusts in Egypt in 1915 and the measures adopted to deal with it.** *Cairo,* 1916. Govt. Press, x + 72 pp., 1 fig., 2 charts, 6 maps. Price 5 piastres.

In 1915 swarms of locusts (*Schistocerca peregrina*) came both from the east and west, as they also did in 1914. Their arrival in the Nile Valley is dependent on weather conditions. Under Egyptian conditions the best method of destruction of hoppers is by driving them

into small trenches and burying. Contact insecticides are useful, but not to the same extent. The adult locusts should be collected and destroyed; the natives do this willingly for a small payment. Internal poisons and *Coccobacillus acridiorum* have proved unsuitable in Egypt. No swarms arrived at maturity and only very little damage was done in general. Cases of appreciable injury were usually due to indifference or negligence on the part of the cultivator or official concerned. Government supervision is absolutely necessary if a locust invasion is to be coped with successfully. The total cost of the locust campaign was £ (E.) 16,927; it saved the cotton crop of the Delta, which was in great danger. Seven appendices are given with this report, one of which deals with the appearance of locusts in the second half of 1915, after the campaign had closed in mid-June. Fortunately no damage was done.

DE PEYERIMHOFF (P.). **Description de la Larve de *Lasiodactylus chevrolati*, Reitt.** [Description of the larva of *L. chevrolati*.]—*Records Ind. Mus., Calcutta*, xii, no. 3, May 1916, pp. 109-113, 3 figs.

The larva of the Nitidulid, *Lasiodactylus chevrolati*, reared from fallen and fermented fruits of *Melia azadirachta* (nim tree) in Madras, is described.

ANDREWS (E. A.). **Insect Pests of Tea in North-East India during the Season 1915.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1916, Part i, pp. 1-6. [Received 23rd June 1916.]

The season of 1915 was characterised by an increase in the numbers of certain minor pests of tea and by the occurrence of a swarm of locusts in the Darjiling, Terai and Duars districts. [See this *Review*, Ser. A, iv., p. 64.] *Helopeltis theivora*, Waterh. (tea mosquito) was very abundant in the northern part of the Terai, below Kurseong, but less numerous than usual around Siliguri. In the western Duars this species caused somewhat serious injury during September, and in the Chulso district in the following month. Injury was recorded at Dum Duma between February and the end of the season and was most serious in October. In various localities in Cachar the insect was present in injurious numbers in October and November, while the Balisera and Luskerpur districts were free from attack throughout the season. *Tetranychus bioculatus*, W.M. (red spider) was present in the northern part of the Darjiling-Terai district during May, and in Cachar and Sylhet gardens affected by floods or difficult to drain suffered from attack. No serious damage was reported from Duars and Assam. Injury by *Termes* sp. occurred in Tezpur, South Sylhet and North Lakhimpur. *Heterusia magnifica*, Butl. (red slug) was more prevalent than usual in one district in Assam during April, July and September-October. Little damage occurred in the Duars and Darjiling-Terai. *Biston suppressaria*, Guen., was present in districts on the right bank of the Brahmaputra; the autumn brood was the most injurious. *Thosea* spp. (nettle grubs) were reported from the Duars. *Clania* spp. (faggot and bag worms) occurred in small numbers in the Duars, Cachar and Mangaldai. A slight attack of *Empoasca flavescens*, F., was recorded from Bishnath during May.

Andrews (E. A.). **Notes on Insect Pests of Green Manure and Shade Trees.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* 1916, Part i, pp. 18–21. [Received 23rd June 1916.]

The Noctuid, *Prodenia litura*, F., attacks tea, tobacco, low-growing leguminous plants, *Phaseolus mungo* and *Sesbania aculeata*. The eggs are laid in masses of from 250 to 300 on the leaves and are protected by hairs derived from the body of the female moth. Hatching takes place in from four to eight days and the larva reaches maturity in from three to four weeks. Pupation occurs in the soil at a depth of about two inches; the duration of this stage varies from one to four weeks. Measures for control include the collection of egg-masses and young larvae. The Pyralid, *Maruca testulalis*, Geyer, feeds in the larval stage on the seeds of pulse; at Borbhetta, Assam, this species was found during September on *Crotalaria juncea* and *Phaseolus mungo* inside the rolled and webbed leaves. Affected pods and leaves should be collected and destroyed. *M. amboinalis*, Feld., was found on the flowers and pods of *Tephrosia candida* at Tocklai in November and should be dealt with in the same way. Another Pyralid, *Nacoleia indicata*, F., is found on most pulses and on *P. mungo*. The larva rolls and webs together the leaves of the host plant. The butterfly, *Terias hecabe*, L., has been found on *Acacia decurrens*. Various species of *Bruchus* attack the seeds of leguminous plants, both stored and in the field. At Tocklai these beetles have been recorded in the seeds of *Tephrosia candida* and *Uraria crinita* and on those of a species of *Desmodium* in the Darjiling district.

Andrews (E. A.). **Entomologist's Tour in the Luskerpore District of South Sylhet.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta,* 1916, Part i, pp. 24–25. [Received 23rd June 1916.]

Two forms of termite nests were observed in the district visited. The first consisted of a mound, which constituted the major portion of the nest, while the royal chamber was placed at or near the soil level. The second type, formed by a species causing serious injury to tea plants, was underground, and was characterised by the presence of auxiliary chambers around and under affected bushes, connected by galleries of apparently very considerable length with the parent nest. *Saissetia* (*Lecanium*) *hemisphaerica*, *Lachnosterna* sp., and *Poecilocoris latus* were present in several localities. *Helopeltis theivora* was found in the Golaghat district, and was easily seen and captured on pruned bushes on which the new leaves were appearing. It was therefore suggested that collecting should begin upon such bushes and that the sections should be treated systematically in the same way. This method of procedure should effectively check the numbers of this insect.

Troup (R. S.). *Pinus longifolia*, **Roxb. A Sylvicultural Study.**—*Indian Forest Mem., Calcutta,* Sylviculture Ser. i, no. 1, 1916, 126 pp., 33 plates. [Received 30th June 1916.]

This memoir is based on observations made during several years in the most important chir pine forests of India. The distribution and character of such forests are discussed and the questions of

natural and artificial regeneration, sylvicultural characters and requirements, systems of management and external dangers are considered. Under the last heading is included an account of the insect enemies of *Pinus longifolia*, of which the following list is given:—(1) Pests of seedlings and young trees in regeneration areas: ACRIDIIDAE: *Teratodes monticollis*, *Chrotogonus* sp. and *Oedaleus abruptus*. SCOLYTIDAE: *Ips longifolia*, Steb., *Polygraphus longifolia*, Steb. CURCULIONIDAE: *Cryptorrhynchus brandisi*, Steb. PYRALIDAE: undertermined species. CECIDOMYIDAE: *Cecidomyia* sp. COCCIDAE: *Ripersia* sp. [see this *Review*, Ser. A, iv., p. 128].

(2) Pests of pole woods and branches of large trees. SCOLYTIDAE: *Ips longifolia*, Steb., *I. ribbentropi*, Steb., *Polygraphus longifolia*, Steb., *Cryphalus major*, Steb., *C. longifolia*, Steb., *Pityogenes coniferae*, Steb., and *Platypus biformis*, Chap. CURCULIONIDAE: *Cryptorrhynchus brandisi*, Steb. BUPRESTIDAE: *Anthaxia osmastoni*, Steb., *A. cholanica*, Kerr., *Capnodis indica*, Thoms. CERAMBYCIDAE: *Nothorrhina muricata*, Dalm. CECYDOMYIDAE: *Cecidomyia* sp.

(3) Pests of mature woods:—SCOLYTIDAE: *Ips longifolia*, *I. ribbentropi*, *Polygraphus longifolia*, *Hylastes longifolia*, Steb., and *Platypus biformis*. CURCULIONIDAE: *Cryptorrhynchus brandisi* and several unidentified weevils. BUPRESTIDAE: *Anthaxia osmastoni*, *Capnodis indica*, *Ancylocheira geometrica*, C. & G. CERAMBYCIDAE *Nothorrhina muricata*.

Polygraphus longifolia attacks pines of all ages; the central chamber occurs either entirely in the bark, or in thin-barked trees, in the bast and sap-wood, while the egg-galleries are found in the outer sap-wood. Three or four generations occur annually. The galleries of *Platypus biformis* are bored horizontally into the sap-wood and heart-wood, and give off vertical branches. The number of generations each year is four or five. *Cryptorrhynchus brandisi* attacks both healthy and weakened trees and newly felled timber. *Ripersia* sp. occurs on the leading shoots and branches of regeneration areas up to ten feet high, and causes an almost complete cessation of growth. Small red ants have been known to cause injury at Dehra Dun by feeding on the seeds before germination, the damage being most severe on bare ground or on areas covered with a layer of pine needles. These ants require further study, since they may be the cause of failure in regeneration.

BODKIN (G. E.). **Report of the Economic Biologist.**—*Rept. Dept. Sci. Agric, [British Guiana], 1914–1915, [Georgetown.]* 17th September 1915, 11 pp. [Received 28th June 1196.]

Control measures against insect pests of sugar-cane were carried out on the majority of estates. These included the cutting out of dead hearts, the collection of egg-masses of the small moth-borer (*Diatraea*), the destruction of the larvae and pupae of *Castnia* in recently cut fields, the use of light traps, and in some instances, the collection and redistribution of parasitised egg-masses. The numbers of *Tomaspis flavilatera*, Urich (froghopper), and *Dyscinetus bidentatus*, Burm. (hardback), appeared to have increased. Rubber was attacked to a certain extent by the Acridiid, *Osmilia flavolineata*, de G., and by the ant, *Atta cephalotes*, L. Coconuts in the Georgetown area were

severely injured by *Brassolis sophorae*, L. [see this *Review*, Ser. A, iv., p. 66]. *Castnia daedalus*, Cram., was present on coconut, but the rate of spread appeared to be slow. *A. cephalotes* proved injurious to young trees in some districts. Attempts to destroy the nests of this ant by the use of carbon bisulphide, calcium carbide and burning sulphur met with only partial success, as the large colonies were almost unaffected. Insect pests of rice included *Diatraea saccharalis*, F., and *Laphygma frugiperda*, S. & A. Cacao and coffee were attacked by scale-insects in several cases. The larvae of the butterfly, *Gynaecia dirce*, were recorded as feeding on the foliage of coffee.

A collection of Thrips made in the Colony comprised the following species:—*Frankliniella insularis*, Frank., from flowers of *Couroupita guyanensis* (cannon-ball tree); *Heliothrips haemorrhoidalis*, Bch., from the underside of the leaves of orange, avocado pear, and other trees; *Diceratothrips armatus*, Bagn.; *Dichactothrips brevicollis*, Hood; *Eupathithrips silvestrii*, Buffa; *Anactinothrips meinerti*, Bagn., from palm; *Hoplandrothrips affinis*, Hood, from beneath leaf-sheaths of sugar-cane; *Heliothrips rubrocinctus*, F., on cacao.

The following list of the ALEURODIDAE occurring in British Guiana is given:—*Dialeurodicus pulcherrimus*, Q. & B.; *Leonardius* sp.; *Aleurodicus cocois*, Curt., on coconut and guava; *A. giganteus*, Q. & B., on *Anona muricata* and *Cananga odorata*; *A. pulvinatus*, Mask., on *Montrichardia aculeata*; *A. neglectus*, Q. & B.; *A.* sp. on *Solanum melongena*; *Paraleurodes* sp. on coconut and ornamental plants; *Eudialeurodicus bodkini*, Q. & B., on *Erythrina glauca*; and *Dialeurodes kirkaldyi*, Kotinsky, on leaves of jessamine.

The following Hymenopterous parasites were reared from hosts of economic importance:—CHALCIDIDAE: *Arrhenophagus chionaspidis* Auriv., from *Chionaspis minor*; *Leptomastix dactylopii*, How., from *Pseudococcus citri*, Risso; *Trichogramma minutum*, Riley, from eggs of *Diatraea saccharalis*, F., *Laphygma frugiperda*, S. & A., etc.; *Holcencyrtus calypso*, Cwfd., and *Elachertus meridionalis*, Cwfd., from larvae of *Calpodes ethlius*, Cram.; *Chalcis pandora*, Cwfd., from the pupa of a Hesperid butterfly; *Heptasmicra curvilineata*, Cam., from the pupa of *D. saccharalis*, F.; *Aplastomorpha pratti*, Cwfd., from *Lasioderma serricorne*, F.; *Lecaniobius cockerelli*, Ashm., from *Saissetia nigra*, Nietn.; *Tetrastichus hagenowii*, Roly.; *Entedononecremnus unica*, Gir., and *Coccophagus magniclavus*, Gir., from pupa-cases of *Eudialeurodicus bodkini*, Q. & B.; *Eupelmus koebelei*, Ashm., from Dipterous larvae. PROCTOTRUPIDAE: *Prophanurus thais*, Cwfd., from the eggs of a Pentatomid bug; *P. alecto*, Cwfd., from eggs of *Diatraea saccharalis*, F.; *P. minutissimus*, Ashm., from eggs of a Noctuid moth; *Aphanurus bodkini*, Cwfd., from eggs of a Pentatomid, *Empicoris variolosus*, L.; *Baeus auraticeps*, Gir., from the egg-sac of a spider.

EASTHAM (J. W.). **Diseases and Pests of Cultivated Plants.**—*Dept. Agric., Hortic. Branch, Victoria, B.C.*, Bull. no. 68, 1916, pp. 5–64. 23 figs. [Received 30th June 1916.]

The life-history, effect on the host, and methods of control of the following insects are briefly described:—*Eriosoma* (*Schizoneura*) *lanigerum* (woolly aphis), *Empoasca* sp. (apple-tree leaf-hopper), *Cydia* (*Carpocapsa*) *pomonella* (codling moth), *Enarmonia prunivora*

(lesser apple-worm), *Eucosma* (*Tmetocera*) *ocellana* (bud-moth), *Lepidosaphes ulmi* (oyster-shell scale), *Aspidiotus ostreaeformis* (European fruit-scale), *A. perniciosus* (San José scale), *Saperda candida* (round-headed apple-tree borer), *Chrysobothris femorata* (flat-headed apple-tree borer), *Cacoecia* (*Archips*) *argyrospila* (fruit-tree leaf roller), *Malacosoma* spp. (tent-caterpillars), *Orgyia* (*Notolophus*) *antiqua* (vapourer moth), *Datana ministra* (yellow-necked apple-tree caterpillar), *Schizura concinna* (red-humped apple-tree caterpillar), *Hyphantria cunea* (fall web-worm), *Lygus pratensis* (tarnished plant-bug), *Euthrips pyri* (pear thrips), *Eriocampoides limacina* (pear slug), *Aegeria* (*Sanninoidea*) *opalescens*, *A.* (*S.*) *exitiosa* (peach-root borers), *Anarsia lineatella* (peach-twig borer), *Pulvinaria innumerabilis* (cottony maple scale), *Aegeria* (*Bembecia*) *marginata* (raspberry-root borer), *Phorbia rubivora* (raspberry-cane borer), *Epochra canadensis* (currant fruit-fly), *Aegeria tipuliformis* (European currant-borer), *Otiorrhynchus ovatus* (strawberry-root weevil), *Lycophotia margaritosa* (*Peridroma saucia*), wireworms, *Chortophila* (*Phorbia*) *brassicae* (cabbage-root maggot), *Hylemyia antiqua* (*P. ceparum*) (onion maggot), *Pieris* (*Pontia*) *rapae* (small white cabbage-butterfly), *Plutella maculipennis* (diamond-back moth), *Epitrix subscrinita* (western potato flea-beetle), grasshoppers, locusts, *Eriophyes pyri* (pear-leaf blister-mite) and *Tetranychus bimaculatus* (red spider).

HOY (B.). **Sprays and Spraying.**—*Dept. Agric., Hortic. Branch, Victoria, B.C.*, Bull. no. 68, 1916, pp. 65–72. [Received 30th June 1916.]

This paper describes the preparation of insecticides suitable for use against biting and sucking insects. In dealing with substances for controlling fungi, a table of dilutions for lime-sulphur is given. A short account is also given of various types of spraying machinery.

The Best Spray for Potatoes.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 23, 15th June 1916.

For the prevention of blight and the destruction of bugs on potatoes, a combination of Bordeaux mixture and arsenate of lead is recommended. The materials are used at the rate of 3 lb. quicklime, 2 lb. copper sulphate, and 2 lb. lead arsenate paste to 50 U.S. gals. water. The spray should be applied every two weeks.

Spray for Rose Beetle.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 23, 15th June 1916.

The spray recommended for use against the rose beetle is prepared according to the formula :—2 ozs. lead arsenate, ½ teacupful molasses, and 1 U.S. gal. water.

HOOD (J. D.). **Descriptions of New Thysanoptera.**—*Proc. Biol. Soc. Washington, Washington*, xxix, 6th June 1916, pp. 109–124, 1 plate.

The following new species of Thrips are described :—*Aeolothrips annectans*, from Maryland, on foliage of *Robinia pseudacacia* and

from Virginia and New York, on foliage of pear; *Heterothrips azaleae*, from Maryland, on flowers of *Azalea nudiflora*; *H. lyoniae*, from New Jersey, on flowers of *Lyonia mariana*; *Sericothrips baptisiae*, from Virginia, on *Baptisia tinctoria*; *Frankliniella citripes*, from Cuba, in citrus flowers; *Physothrips pictus*, from South Nigeria, in flowers of *Melia azedarach*; *Odontothrips pictipennis*, from Virginia, in flowers of *Azalea nudiflora*; *Pseudothrips spadix*, from Panama, on an undetermined plant; *Chilothrips pini*, gen. et sp. n., from Maryland and Virginia, on twigs and leaves of *Pinus virginiana*; *Haplothrips maliflorís*, from New Mexico, on flower of apple; *Trichothrips fusicornis*, from Maryland.

De Ong (E. R.). **Soaps and Miscible Oils.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 5, May 1916, pp. 172–176.

Fish-oil soap is prepared according to the following formula:—3 gals. fish-oil, 4 lb. caustic potash, 8 U.S gals. water. Against Aphids the soap should be used at the rate of 1 lb. to 8 gals. water. Cresol soap used in the preparation of miscible oils consists of 1 gal. fish-oil soap, 1·5 gals. cresylic acid and 0·5 lb. caustic soda. The soda and oil are heated together until the former is dissolved, then the cresylic acid is added and the mixture raised to a temperature of from 290° to 300° F. This soap will keep for any length of time. If required for the manufacture of an oil emulsion, 3 gals. kerosene should be added to the warm liquid and then 2 gals. water. When used in combination with distillate or crude oil, the soap should be mixed when cold with from 5 to 10 times its volume of oil. The necessary dilution may be calculated from the volume of oil used; if the soap dissolves six times its volume of oil, the resulting mixture contains 93·4 per cent. of oil, and to obtain a 7 per cent. emulsion, 7·5 gals. of the stock emulsion are added to 92·5 gals. water.

G. P. W. **Alfalfa Weevil Quarantine Conference.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v. no. 5, May 1916, pp. 186–187.

A conference was held at Salt Lake City during April to discuss the alfalfa weevil [*Hypera variabilis*] and to consider quarantine regulations which should aim at preventing the passage of goods liable to convey this weevil from infested to non-infested States. In the opinion of those present, a restrictive quarantine should be placed on potatoes coming from Utah. With the exception of the representatives of that State, there was a general agreement in favour of an absolute quarantine on hay and cereal straw. A quarantine on lucerne seed and bees was not regarded as essential.

E. J. V. **Alfalfa Weevil Inspection.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 5, May 1916, p. 188.

The annual inspection of the lucerne-growing districts in San Bernardino county along the Salt Lake route failed to show the presence of the weevil [*Hypera variabilis*]. This route crosses infested areas in Utah and may become a factor in the distribution of the insect.

Compere (H.). **Notes on the Tomato Psylla.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* v, no. 5, May 1916, pp. 189-191, 3 figs.

The Psyllid, *Paratrioza cockerelli*, Sulc., is distributed throughout the south-western part of the United States and has been recorded on the following host plants :—*Capsicum annuum* (pepper), *Solanum lycopersicum* (tomato), *S. tuberosum* (potato), *Purshia* sp., *Thuja occidentalis* (arbor vitae), *Picea* sp. (spruce), *Pinus monophylla*, *Medicago sativa* (lucerne); the specimens under consideration were taken from *S. capsicastrum* (Jerusalem cherry). In Sacramento broods are continuous throughout the year. During January the mortality among the newly-hatched nymphs may reach 50 per cent. if the temperature is very low. Adults in captivity were extremely active and lived more than a month. Oviposition began three days after pairing and continued for three days. Eggs were deposited on any part of the leaf; the average number laid by one female was thirty-six. The incubation period in a hot-house was 15 days, while the nymphs reached maturity in about 30 days. Suitable methods of control were spraying with water and Black Leaf 40, at a strength of 1 to 1,500 (for thin-leaved ornamental plants), or kerosene emulsion and 1 to 20 U.S. gals. water (for more resistant plants).

Essig (E. O.). **Two Newly-Established Scale Insects.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* v, no. 5, May 1916, pp. 192-197, 6 figs.

Pulvinaria floccifera, Westw. (camellia scale) at present occurs in California only in the San Josè district. The favourite host is *Camellia japonica*, other food-plants being *Euonymus* sp., *Oncidium papilio*, coffee, *Calanthe natalensis*, *Brassia verrucosa*, *Anguloa clowesii* and *Lycaste skinneri*. Outside California this species is found in the south and east of the United States and in Canada. Immature forms can be readily killed during the winter months by the use of oil emulsions and miscible oil sprays. *Chrysomphalus dictyospermi*, Morg., has been found on greenhouse plants at Berkeley, Marysville, and San Diego. The host plants are Kentia palms, orchids, avocado and *Coelogyne cristata*. In Spain, Italy and Sicily, this insect is an important pest of citrus trees. Other food-plants are *Dictyospermum album*, *Cycas* sp., mango, *Pandanus graminifolius*, etc. Control measures, other than the destruction of infested plants, have not been resorted to in California.

Maskew (F.). **Quarantine Division; Report for the Month of March 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* v, no. 5, May 1916, pp. 198-200.

The following insect pests were intercepted :—

From China: *Chionaspis* sp. on unknown plant. From Hawaii: *Pseudococcus bromeliae* and *Diaspis bromeliae* on pineapple; *Coccus longulus* on betel leaves; *Lepidosaphes beckii*, *Lecanium* sp., *Ischnaspis longirostris*, *Morganella maskelli*, *Howardia biclavis*, *Parlatoria pergandii* and *Chionaspis* sp. on plants and cuttings; Coleopterous larvae in melon seeds; *Hemichionaspis minor* on green coconuts; *Chionaspis* sp. on air plant; *Pseudococcus* sp. and *H. biclavis* on guava roots.

From Japan: *Pseudaonidia duplex* and *Pseudococcus* sp. on azaleas; larvae of a leaf-roller on pines; *Antonina crawi* on bamboo; *Ceroplastes ceriferus*, *Pseudaonidia paeoniae* and *Lepidosaphes lasianthi* on camellias; *Hemichionaspis aspidistrae* and *Chrysomphalus ficus* on *Aspidistra lurida*; *Lepidosaphes newsteadi* on umbrella pines. From Massachusetts: *Heliothrips haemorrhoidalis* on citrus trees. From Mexico: *Lepidosaphes gloveri*, on limes; *Bruchus* (*Acanthoscelides*) *obtectus* on beans; *Chrysomphalus aonidum* and *Aspidiotus* sp. on coconuts. From Oregon: *Lepidosaphes ulmi* on a deciduous tree. From Papeete: *Carpophilus hemipterus* and Lepidopterous larvae in avocado seed, and a Coleopterous borer in palm seed. From Valparaiso: Lepidopterous larvae in potatoes. From Central America: *Aspidiotus cyanophylli*, *Icerya* sp., and *A. cydoniae* on bananas. From Iowa: *Eriosoma lanigerum* on *Malus scheideckeri*. From Louisiana: *Aleurodes* sp. on Cape jasmine and *Lepidosaphes lasianthi* on camellia. From Ohio: *Aleurodes* sp. on lemon plant. From Utah: *Lepidosaphes beckii* and *Phomopsis citri* on grapefruit. From Florida: *Lepidosaphes* sp. on orange and grapefruit. From Nebraska: woolly aphis on deciduous stock.

GOSSARD (H. A.) & GREEN (W. J.). **Spraying Programs for the small Home Orchard and Fruit-Garden.**—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster*, i, no. 4, April 1916, pp. 103-107. [Received 26th June 1916.]

Methods and materials for spraying apple, plum, pear and peach in Ohio have been previously described [see this *Review*, Ser A, iii, p. 301]. For cherry, the following sprays are recommended:—(1) dormant lime-sulphur spray; (2) Bordeaux mixture, 2-2-50 formula, and lead arsenate, at the rate of 3 lb. paste to 50 U.S. gals., when the leaves are unfolding; (3) lead arsenate at the same strength, with the addition of 1 part nicotine sulphate in 500 parts of spray and 2 lb. soap to every 50 gals., just after the blossoms fall; (4) the same without the soap a week later; (5) Bordeaux mixture and lead arsenate as in (2) if necessary after the fruit is picked. Grapes should be treated as follows:—(1) three sprays at intervals of 1 or 2 weeks of Bordeaux mixture, 4-4-50 formula, the first applied just before the flowers open; 4 lb. lead arsenate may be added to the last application; (2) Bordeaux mixture, 2-3-50 formula, with 6 lb. lead arsenate paste and 2 lb. soap to 50 gals. applied under high pressure to the fruit from 1st to 10th August. Gooseberry and currant bushes should be sprayed with (1) dormant spray; (2) Bordeaux mixture, 4-4-50 formula, when the leaves are unfolding; (3) Bordeaux mixture, 4-4-50 formula, lead arsenate, 3 lb. to 50 gals. and 1 part nicotine sulphate to 700 parts of spray when the flowers are opening; (4) 1 part hellebore and 4 parts slaked lime or 1 part Paris green and 4 parts lime if the currant worm is present. For raspberry and blackberry the following should be used:—(1) dormant spray; (2) lead arsenate paste, 3 lb. to 50 gals., when the buds are opening if *Byturus unicolor* is present; (3) a second application of the same spray if necessary when the flowers are open; (4) Bordeaux mixture, 4-4-50 formula, for young canes about 6 inches high. Strawberries should be treated with (1) Bordeaux mixture, 6-6-50 formula, before flowering; (2) hellebore, 1 oz. to 1 gal. water in May or early June.

Thayer (P.). Spray Formulas for the Town Lot.—*Mthly. Bull. Ohio. Agric. Expt. Sta., Wooster*, i, no. 4, April 1916, pp. 114–116. [Received 26th June 1916.]

This paper describes the preparation of the more important sprays in ordinary use in quantities sufficient for treating small numbers of affected plants.

Smyth (E. G.). Report of the South Coast Laboratory.—*4th Rept. Bd. Commissioners Agric. Porto Rico from 1st July 1914 to 30th June 1915, San Juan*, 1916, pp. 45–50. [Received 27th June 1916.]

The leaves of sugar-cane in San Domingo are eaten by the caterpillars of *Calisto archebates* and serious damage has been done by it in that island. To prevent the introduction of this and other pests of sugar-cane, the holds of the cane-carrying boats are fumigated with sulphur when leaving the port of La Romana and each boat-load is inspected on arrival at Porto Rico and infested material destroyed. All fruits and plants brought by passengers from San Domingo are similarly inspected and a number of pests, chiefly scale-insects and whiteflies, have been intercepted in this way.

Investigations on white grubs which attack sugar-cane were carried out during the year. The life-histories of the following species known to injure sugar-cane in Porto Rico were determined:—*Lachnosterna grandis*, *L. media*, *L. pequena*, *Ligyrus tumulosus*, *Strategus titanus*, *S. quadrifoveatus*, *Dyscinetus trachypygus* and *D. barbatus*. *L. grandis* and *L. media* were found to vary on the north and south sides of the island. In the north, the varieties of both species fed on *Poinciana regia*, *Casuarina equesitifolia* and *Terminalia catappa*; in the south *L. grandis* fed on the leaves of coconut and *L. media* on *Acalypha* sp. and *Citrus* spp. Adults of *L. media* appeared at Santa Rita between March and June, while *L. grandis* was present in both spring and autumn. *L. pequena* was found from July to September on *Amaranthus* sp. and *Panicum barbinode* among the sugar-cane. *S. titanus* is an important boring pest, the life-cycle of which occupies more than a year. *S. quadrifoveatus* was present on cane on two occasions. Under experimental conditions, the larvae fed on cane stubble during the first instar only, and afterwards preferred rotting wood. Larvae of *Ligyrus tumulosus* occurred in stumps of cane which were beginning to decay, and were rarely found in living stems. The complete life-cycle occupied 110 days and there are probably three generations annually. *D. trachypygus* and *D. barbatus* have at least two generations each year; the larvae were seen to feed on cane stubble, etc., and did not attack the living plant.

Merrill (G. B.). Report of the Tobacco Insect Investigations.—*4th Rept. Bd. Commissioners Agric. Porto Rico from 1st July 1914 to 30th June 1915, San Juan*, 1916, pp. 50–52. [Received 27th June 1916.]

Insect pests of tobacco in Porto Rico include the flea-beetles, *Epitrix fuscata*, Duv., and *E. parvula*, F., *Scapteriscus didactylus*, Latr. (changa or mole cricket) and *Protoparce* (*Phlegethontius*) *sexta*, Joh. (hornworm).

Pests of minor importance are cutworms, wireworms, *Diaprepes spengleri*, etc. *E. fuscata* is usually abundant throughout the season in the districts east of Arecibo and San German, while *E. parvula* is less numerous but more widely spread. Plants in seed beds and those newly planted out are very liable to attack, while older plants are also injured. Dry arsenate of lead and finely powdered wood ashes mixed together are recommended for dusting over the plants. The mixture should not contain more than 50 per cent. of lead arsenate. *S. didactylus* causes serious injury in seed-beds. A suitable remedy consists in scattering a mixture consisting of three parts Paris green and 97 parts flour among the plants. *P. sexta* is normally checked by a Proctotrupid parasite of the egg and by a Dipterous and a Braconid parasite of the larva. When exceptionally abundant, it can be controlled by the lead arsenate and wood ash mixture and by hand-picking.

Timberlake (P. H.). **Revision of the Parasitic Hymenopterous Insects of the Genus *Aphycus*, Mayr, with Notice of some Related Genera.** —*Proc. U.S. Nat. Mus., Washington.* l, no. 2136, 31st May 1916. pp. 561-640, 6 plates.

Descriptions are given of the following genera:—*Aphycus*, Mayr, *Pseudococcobius*, gen. n., *Bothriocraera*, gen. n., *Acerophagus*, Smith, *Pseudophycus*, Claus., *Aenasioidea*, Gir., and *Aphycopsis*, gen. n., with keys to the species contained in them.

Cockerell (T. D. A.) & Robinson (Elizabeth). **Descriptions and Records of Coccidae.**—*Bull. American Mus. Nat. Hist., New York,* xxxiv, 1915, pp. 105-111, 2 plates. [Received 26th June 1916.]

The following species of Coccidae are recorded:—*Trionymus violascens*, Ckll., on grasses in Colorado; *Eriococcus costaricensis*, sp. n, on *Vaccinium* from Costa Rica; *E. tinsleyi*, Ckll., on *Malvastrum coccineum* in Colorado; *Pseudococcus filamentosus*, Ckll., on *Coffea* from Mindanao; *Gossyparia spuria*, Mod., on elm bark from Colorado; *Fonscolombia braggi*, sp. n., on roots of *Berberis repens* from Colorado; *Ripersia trichura*, Ckll., in nests of *Lasius americanus* and *Formica* sp. from Colorado; *Aspidiotus translucens*, Ckll., on *Carica papaya*, *Dioscorea alata*, *Aleurites moluccana*, *Mangifera indica* and *Codiaeum* from the Philippines; *Hemichionaspis aspidistrae*, Sign.; *Aspidiotus ehrhorni*, Coleman, on *Abies* and *Libocedrus* and among lichens on the bark of *Pseudotsuga mucronata* from Colorado; *Chrysomphalus pedroniformis*, sp. n., on the bark of *Vitis vinifera* from the Philippine Islands; *Fiorinia phantasma*, sp. n., on leaves of *Neolitsea* from the Philippines; *Pseudaonidia obsita*, sp. n., on leaves of *Ficus caudatifolia* from the Philippines; *Pinnaspis siphonodontis*, sp. n., and *Neolecanium cribrigerum*, sp. n., on the leaves of *Siphonodon celastrineus* and *Piper loheri*, respectively, from the Philippines.

COCKERELL (T. D. A.) & ROBINSON (Elizabeth). **Descriptions and Records of Coccidae.**—*Bull. American Mus. Nat. Hist., New York*, xxxiv, 1915, pp. 423-428, 3 figs. [Received 26th June 1916.]

The species of COCCIDAE from the Philippine Islands described and recorded include the following:—DIASPINAE: *Schizaspis lobata*, gen. et sp. n., on the under side of leaves of *Ficus nota*; *Aspidiotus coryphae*, sp. n., on the leaf-bases of *Corypha elata*; *Lepidosaphes ixorae*, sp. n., on stems of *Ixora coccinea*; *Parlatoria zizyphus*, Luc., on *Citrus decumana*; *P. pergandii*, Comst., and *Fiorinia fioriniae*, Targ., on leaves of *Celtis philippinensis*; *Pinnaspis siphonodontis*, C. & R., on *C. philippinensis*; *Pseudaonidia curculiginis*, Green, on leaf-bases of *Corypha elata*; *Chrysomphalus pedroniformis*, C. & R., and *C. aonidum*, L., on *Citrus nobilis* and *Caryota*; *Aspidiotus rapax*, Comst., on orange; *A. cydoniae* var. *greenii*, Ckll., on *Chrysanthemum* and fruits of *Achras sapota*; *A. translucens*, Ckll., on *Musa sapientum* and *Tamarindus indicus*. LECANIINAE; *Platylecanium* (*Neolecanium*) *cribrigerum*, C. & R.; *Pulvinaria thespesiae*, Green, on *Codiaeum variegatum*; *P. psidii*, Mask., on *Psidium guayava*, *Antidesma bunius* and *Eugenia jambos*; *Saissetia nigra*, Nietn., on *Withamia origanifolia*; *S. hemisphaerica*, Targ., on leaves of *Anona muricata*; *Paralecanium luzonicum*, Ckll., on *Tetrastigma*; *Coccus elongatus*, Sign., on *Anona squamosa*; *C. viridis*, Green, on *Citrus nobilis*, *C. decumanus*, *Antidesma bunius* and *Gardenia florida*. DACTYLOPIINAE: *Pseudococcus virgatus*, Ckll., on *Graptophyllum*, *Codiaeum variegatum*, *Caesalpinia pulcherrima*, etc.; *Asterolecanium pustulans*, Ckll., on *Bauhinia* (from Brazil). MONOPHLEBINAE: *Icerya seychellarum*, Westw., on *Citrus decumanus*.

BRITTAIN (W. H.). **Some Hemiptera Attacking the Apple.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 7-47. [Received 28th June 1916.]

This is a brief account of some of the more important Rhynchota attacking the apple in Nova Scotia. The species dealt with are: *Aphis pomi*, De G. (green apple aphis), *A. sorbi*, Kalt. (rosy apple aphis), *Eriosoma lanigerum*, Hausm. (woolly apple aphis), *Empoa rosae*, L. (rose-leaf hopper), *Idiocerus fitchi*, Van D. (*maculipennis*, Fitch) (black apple-leaf hopper), *Aspidiotus perniciosus*, Comst. (San José scale), *Lepidosaphes ulmi*, L. (oyster-shell scale), *Chionaspis furfura*, Fitch (scurfy scale), *Aspidiotus ostreaeformis*, Curtis, *Lygus invitus*, Say, var. *novascotiensis*, Knight (green apple bug).

SANDERS (G. E.). **The Brown Tail Moth in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 47-53. [Received 28th June 1916.]

A large amount of data has been collected in this paper on the brown-tail moth [*Euproctis chrysorrhoea*] in Nova Scotia [see this *Review*, Ser. A, iv, p. 119]. By spraying and by collecting the nests it is hoped to keep the pest down until the introduction of parasites is sufficiently advanced to hold it in check without the winter collection of the nests.

ENTOMOLOGICAL NOTICES.

During May and June of this year, Professor H. Maxwell Lefroy (Temporary Lt.-Col., R.A.M.C.) was on special duty in Mesopotamia connected with fly investigations.

We regret to record that Secd.-Lt. R. A. F. Eminson, King's Royal Rifle Corps, has been killed in action. Mr. Eminson had recently carried out some valuable investigations into the bionomics of *Glossina morsitans* in Northern Rhodesia.

BAKER (A. C.) & DAVIDSON (W. M.). **Woolly Pear Aphis.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 10, 5th June 1916, 1 fig.

An Aphid which was thought to be *Eriosoma lanigerum*, Hausm. (woolly apple aphis) and has been known to attack pear roots in California for some years past [see this *Review*, Ser. A, iii, p. 738], has proved to be undescribed and has been named *Eriosoma pyricola*. It is believed that *E. pyricola* has been present in California for more than twenty years and it is possible that this species may be found in other parts of the country, notably in Oregon. It occurs over practically all the pear-growing areas of northern and central California and in some regions is very destructive. It lives entirely underground, and the species that has been found feeding on the aerial portions of pears is *E. lanigerum*. *E. pyricola* appears to attack the roots of all types of pears and is especially injurious to the French wild stock so largely used in California. Quince roots are attacked, but are largely immune. The Kieffer stock is attacked, but it is possible that Japanese stock may show immunity to a satisfactory degree. Both seem more resistant than stock from France. This Aphid especially attacks the smaller fibrous roots, and on trees under four years old heavy infestation may result in the death of the tree. Badly stunted growth and the early falling of foliage are characteristic results of attack on young trees. The majority of old infested trees do not show evident injury. In orchards and districts where conditions favour large numbers of winged forms or migrants, spring and early summer infestations are small, indicating that few insects have passed the winter in the roots. After June, such infestations multiply rapidly and become very large by September, the month in which the autumn migrants are produced in the greatest abundance. After September there remain small wingless colonies, which increase but little until the following summer. The winged forms are produced in abundance on heavy, dry, clay soils which crack in summer and autumn. Irrigated orchards produce them in smaller numbers than those that receive no moisture from May to October. On loam, silt, and light clay soils the winged forms are much less abundantly produced, and the conditions are generally unfavourable to such heavy infestations as occur on the heavy clays. In nurseries under favourable conditions the spread of the insect may be rapid. A half-acre pear nursery examined in June 1915 failed to show infestation, though the Aphid was probably present. In October more than half the trees examined were infested, some quite heavily. Infestation in young orchards generally points to the nursery as the source.

The biology and description of this insect are given in detail. The wingless and nymphal forms live chiefly on the small rootlets and less frequently on the larger roots and the underground portions of the suckers. The winged forms have been noticed on pear foliage and on the trunk, but, with one exception, no deposition of sexual forms has been observed on the pear. On cork and American elms (*Ulmus* spp.) migrants were observed to deposit the sexual forms in cracks in the bark and on the lower surface of the leaves. In one instance migration from a nursery of pear trees to a group of young elms 200 yards distant could be traced. The migrants fly readily and strongly, and are more active on warm days. On elms they are more abundant

(C294) Wt.P1/106. 1,500. 9.16. B.& F.Ltd. Gp.11/3

on trees with rough bark. The sexual forms have no woolly covering such as occurs in *Eriosoma lanigerum*. A comparative table is given of the life-history of *E. pyricola* and *E. lanigerum* and another table shows the distinctions between the autumn migrants of *E. pyricola* and those of *E. lanigerum* and *E. americanum*.

GOOD (C. A.). **The Apple Maggot in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 54–69, 5 figs. [Received 28th June 1916.]

The first official record of the apple maggot [*Rhagoletis pomonella*] was made in Nova Scotia in 1913. Inspection in 1915 showed its distribution in the province to be far wider than was suspected. Disease, parasitism and predatory insects cause great mortality among the eggs, larvae and pupae. In 1914 Mr. W. C. Woods reared a parasite, *Biosteres rhagoletis* [see this *Review*, Ser. A, iii, p. 753] and the author found this insect in Digby county, ovipositing in apples. The adults begin to emerge about the third week in July and continue to do so until nearly the end of September. To determine the depth from which they can emerge, pupae were buried at different depths in special rearing boxes, the soil being pressed above them, but not pounded. Flies emerged from a depth of 24 inches and a depth of 6 inches had not the slightest effect, so that ploughing under infested fruit would be of little use. Early-maturing sweet or sub-acid varieties of apple seem to be more seriously attacked than acid ones. Thick-skinned apples are not badly attacked. The adults do not appear to fly long distances. In captivity several flies lived for six weeks. The egg, larva and pupa are described. Control methods include the destruction of fallen fruit, which is very laborious, but if carefully carried on for two or three years, will effectively control the pest. Fowls in the orchard render valuable service. Experiments with a sweetened poison spray have proved it to be efficient. The formula used was: lead arsenate paste 3 lb., molasses 1 gal., flour 2 lb., water 40 gals. The flour is first made into a paste and is used to increase the adhesive power of the spray, since the molasses almost completely spoils the adhering qualities of the lead arsenate.

SANDERS (G. E.). **Budmoths in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 84–85. [Received 28th June 1916.]

At present four species of bud-moths are known to attack the apple in Nova Scotia. In order of abundance they are: *Eucosma (Spilonota) ocellana*, Schiff. (eye-spotted bud-moth), *Tortrix (Archips) rosaceana*, Harr. (oblique-banded leaf-roller), *Olethreutes consanguinana (O. frigidana)* and *Recurvaria nanella*, Hb. (lesser bud-moth). They all pass the winter as larvae in hibernating cocoons, emerging as the buds begin to swell in the spring and boring into the opening tips. Some pupate during or immediately after the blossoming period, others three or four weeks later. All pupate among the leaves and all oviposit on them. *T. rosaceana* deposits its eggs in a mass, the others depositing them singly. They are all single-brooded in Nova Scotia.

Counts made in 1913 and 1915 showed the set in infested blossom-clusters to be reduced 74·7 and 79·4 per cent. respectively. Autumn injury to the foliage is negligible, but serious loss is caused by those species which tie the leaves to the apples and spoil their surface. In Nova Scotia the average infestation in unsprayed orchards for all varieties is about 40 per cent., which is equal to an average reduction of crop of 30 per cent. Varieties with wrinkled twigs are almost invariably more heavily infested than clean-limbed ones, owing to the better protection offered to the cocoon. For control, a spray containing 5 to 7 lb. of lead arsenate or 2 lb. of lime arsenate to 100 gals. of water, is recommended. This should be applied when the leaves are about the size of a sixpence, using a drive-nozzle immediately before the blossoms are open and a calyx- or drive-nozzle afterwards.

SANDERS (G. E.). **Fruit Worms or Apple Worms in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro,* no. 1, 3rd August 1915, pp. 87–89. [Received 28th June 1916.]

The fruit worms present in Nova Scotia probably number a dozen species, belonging to the genera *Xylina*, *Calocampa* and *Scopelosoma*. The damage done by all the species and their life-histories are very similar. *Graptolitha* (*Xylina*) *bethunei*, G. & R., is the most common species, far outnumbering all the others combined. The adult emerges in September or early October, hibernates under rubbish in old fences, grass, etc., and is one of the first moths to be found on the wing in spring, usually in early April. About one month later it begins to oviposit on the apple, the eggs being deposited singly. Eighteen days later the larva emerges and begins to feed on the leaves. For the first three weeks of its existence it feeds on the leaves and blossoms. At the beginning of the third instar it forsakes the foliage almost entirely and feeds on the fruit, usually biting into a new apple for each meal. After five months the larva begins to pupate about 12th July. The pupa is formed in a very thin silken web, one or two inches below the surface of the soil. The first adults emerge about 15th September. In cases where feeding is confined to the outer pulp, the injury heals, forming a somewhat regular roughened area with very little or no malformation. It has been found by actual count that 72 per cent. of the apples attacked by fruit worms in the spring drop. The percentage of fruit worms has been found to vary directly with the position of the orchard, the more sheltered ones being more seriously attacked. Spraying immediately before the blossoming, and again immediately after, caused a reduction in injury of 65 per cent. The larvae of *G. bethunei* have been noticed gnawing through the cocoons of *Malacosoma disstria* and *M. americana*. In 1913, 34–82 per cent. of the *M. disstria* cocoons collected on apple, on 12th and 13th July, were found to have been thus destroyed.

SANDERS (G. E.). **The Codling Moth in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro,* no. 1, 3rd August 1915, p. 90. [Received 28th June 1916.]

This note records the comparative scarcity of the codling moth [*Cydia pomonella*] in Nova Scotia, it being very rare to find over five per cent. of infested apples even in unsprayed orchards. No definite indications of a second brood have been found.

SANDERS (G. E.). **The Canker Worm in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 91–92. [Received 28th June 1916.]

During 1915 a great many orchards in the Annapolis Valley were defoliated by canker worms, *Alsophila pometaria*, Harr., being the most common species. Tanglefoot bands provide an ideal method of control, but where these are not used, spraying is necessary. As this pest is difficult to poison after it is one-third grown, the only way to control it is to use an excess of poison—8 to 10 lb. of lead arsenate to 100 gals. of water—and cover the leaves thoroughly with the spray when the young larvae are beginning to feed.

SANDERS (G. E.). **The Tussock Moth in Nova Scotia.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 93–94. [Received 28th June 1916.]

The white-marked tussock moth (*Hemerocampa leucostigma*) is common in Nova Scotia and periodically does extensive damage to orchard and shade trees. As a serious outbreak appears to be possible, growers are advised to examine the trees, pick off the winter egg-masses and add plenty of poison to the last summer spray, or to the spray to be applied about 25th–30th June 1916. The eggs are deposited on the old pupa-case and may be found among the twigs and branches of the tree. They are laid about 30th August and hatch about 27th June the next year. The caterpillars reach maturity about 11th August.

GOODERHAM (C. B.). **Parsnip Webworm** (*Depressaria heracleana*).—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 94–95. [Received 28th June 1916.]

In Nova Scotia, the wild parsnip is attacked by *Depressaria heracleana* (parsnip webworm), which has also seriously injured parsnips grown for seed. *D. heracleana* deposits its eggs singly on the leaves and stems of the plant during the second and third week of June. They hatch in a few days and the young caterpillar immediately eats its way through the sheath which covers the seed head. When it reaches the young flower bud inside, it commences to feed, and ties the flowers together with silken threads. Feeding continues for about four weeks, the seed being completely destroyed and the leaves often entirely eaten. About mid-July the nearly mature larva crawls down the stem of the plant until it reaches the axil of a leaf, when it eats its way into the hollow stem, and there it feeds for a few days before reaching maturity. When mature, it spins a small silken cocoon in the stem and enters the pupal state, which lasts for about two or three weeks, the adults emerging about the second or third week in August. It passes the winter as an adult. No satisfactory control has yet been worked out. The only way to check it is to cut off all affected heads and destroy them.

BRITTAIN (W. H.). *Hydroecia micacea* **as a garden pest.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 96-97. [Received 28th June 1916.]

In the early summer of 1914 a boring caterpillar appeared in large numbers in the rhubarb plantation on the Nova Scotia Agricultural College Farm and practically destroyed the crop. The adults have been identified as *Hydroecia micacea*, Esp. No sign of injury is noticed until about mid-June or later, when the leaves begin to wilt, and on cutting into an injured plant the larvae will be found boring in all directions through the crown or in the stem. Late in July or early in August the larvae pass into the ground and enter the pupal stage. The adults emerge during August and September. The first eggs were found on 31st August, the favourite place of deposition being the stems of *Agropyron repens* (couch grass) which was abundant in the rhubarb plantation. This fact indicates the necessity for destroying all weeds, etc., upon which the eggs are likely to be laid. Besides injuring rhubarb, *H. micacea* has done considerable damage to potatoes. This pest is of European origin and in England is known as the potato stalk borer. A bibliography of twelve works concludes this paper.

DUSTAN (A. G.). **The Oblique Banded Leaf Roller,** *Archips rosaceana*, **Harr.**—*Proc. Entom. Soc. Nova Scotia, Truro*, no. 1, 3rd August 1915, pp. 100-102. [Received 28th June 1916.]

Tortrix (Archips) rosaceana, Harr. (oblique-banded leaf-roller) is one of the commonest leaf-rollers in Nova Scotia, where it does considerable damage to the foliage in spring and early summer and again in autumn. The partly grown larvae pass the winter in small nests found at the tips of the twigs and fruit spurs, hidden under small pieces of bark, dead leaves or bud scales. When the tips of the buds show green, the minute caterpillars emerge, feeding on the tender foliage and boring into the centre of the bud. As the leaves unfold, the larvae leave the buds and feed upon the new foliage, rolling and tying down the edges of the leaves so as to form a shelter within which they feed and rest. When mature, usually in the second half of June, they transform in their nests to pupae from which the adults emerge in about two weeks. There is only one brood a year in Nova Scotia. Descriptions of the egg, larva and pupa are given.

GRANDI (G.). **Gli Agaonini (Hymenoptera, Chalcididae) raccolti nell' Africa Occidentale dal Prof. F. Silvestri.** [The Agaoninae collected in West Africa by Prof. F. Silvestri.]—Separate, dated 26th April 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric. Portici*, x, 1916, pp. 121-286, 52 figs. [Received 20th June 1916.]

This systematic paper describes AGAONINAE living on wild fig trees in West Africa; a few species collected in the Cape Verde Islands by L. Fea are also included. Many of the species are new.

MORDWILKO (A. K.). О нѣкоторыхъ старыхъ и новыхъ тляхъ. [On some new and old species of Aphids.]—«Русское Энтомологическое Обозрѣніе.» [*Revue Russe d'Entomologie*], *Petrograd*, xv, no. 4, 28th March 1916, pp. 75–79.

This paper, read at a meeting of the Russian Entomological Society in November 1915, deals further with a previously expressed view of the author, that the regular migration of Aphids in a development from the polyphagous habits of the species. The group *Aphidea*, of the subfamily APHIDINAE, provides evidence in support of this view, it being possible to trace a line of forms which pass from polyphagous conditions to regular migration from the so-called base plants (usually the above-ground parts of herbaceous plants) to the intermediate ones, which in this case are various grasses. Such migrations and the occurrence of forms entirely attached to some intermediate plants were however unknown in the case of the group *Anoeciea* of the subfamily APHIDINAE or of the subfamily PEMPHIGINAE. Though Nüsslin, while accepting this view, limited it to the subfamily APHIDINAE among the APHIDIDAE, the author has recently discovered evidence which makes it clear that this also occurs in the above-named groups. In August 1915, he found a new species, *Anoecia pskovica*, in the government of Pskov on the roots of grasses, the sexual form of which breeds on the roots, the eggs also hibernating there. Thus in the genus *Anoecia* one species, *A. corni*, F., migrates from various species of *Cornus* to the roots of grasses, while the other, *A. pskovica*, is entirely a root-frequenting species. It is therefore suggested that these Aphids originally occurred both on trees and grasses and subsequently split into more specialised forms, some of which became exclusively associated with one kind of plant, the others becoming migratory. The same phenomenon has also been recently proved to occur in the case of the group *Fordea* of the subfamily PEMPHIGINAE, some species of the genus *Pemphigellus* migrating from *Pistacea* to roots of grasses, while others are entirely attached to such roots (*Forda*, *Paracletus*). Although the author has previously always separated *Forda* and *Pemphigellus* into two groups, they possess great similarities, particularly the winged forms of *Forda* and the winged sexuparae of *Pemphigellus*. He therefore now places *Fordea*, with its subdivisions, *Fordina* and *Rectinasina*, as a third, natural group of the subfamily PEMPHIGINAE, the other two being *Pemphigea* and *Schizoneurea*.

This paper also describes *Rectinasus shelkovnikovi*, sp. n., from an ant-hill in the mountains of Elisavetpol (Transcaucasia), which closely resembles *R. bucktoni*, Theo., found in termite nests in Algiers. Notes are also given on the differences between the migratory form of *Tetraneura ulmi*, L., and *T. rubra*, Licht. The former has been recorded as *T. zeae-maidis*, Duf., *T. boyeri*, Pass., and *T. coerulescens*, Mordv., and the latter as *T. coerulescens*, Pass. A representative of the group, *Trichosipha kuwanae*, Perg., has been found in South Ussuria at the ends of oak shoots. This group also occurs in Ceylon, Java and Japan. The wide distribution of *Aphis maidis*, Fitch (= *avenae*, Kalt., nec F., nec Mordv.), which is found in Europe, Caucasia, Siberia, Japan, Java, North America, Africa, and Australia, is due to the similarly extensive distribution of the grass, *Panicum crus-galli*, which is one of its food-plants.

KULAGIN (Prof. N. M.). **Главнѣйшія вредныя для полеводства насѣкомыя Европейской Россіи.** [The chief insect-pests of field-crops in European Russia.]—**« Календарь Русской Природы.»** [*Calendar of Russian Natural History*], *Moscow*, 1916, pp. 100–120.

The author briefly reviews the available records of the influence of climatic and meteorological conditions on the development of insects, with a summary of the data concerning the chief insect pests of field crops in European Russia for a number of years. The tables given show the time of appearance of the different stages in various governments of *Anisoplia austriaca*, Hbst., for the years 1880–1914, the beetles being mostly present in May and the larvae hibernating twice; various Elaterids for 1900–1914; *Euxoa segetum*, Schiff., for 1880–1914, which has two broods in South Russia and one in the North; *Oria musculosa* for 1882–1914, of which according to Lindeman two generations occur, but only one according to Mokrzecki and others, the eggs hibernating; *Phlyctaenodes sticticalis*, L., for 1853–1915, which has two and sometimes three generations; *Mayetiola* (*Cecidomyia*) *destructor*, Say, for 1879–1912; *Oscinella* (*Oscinis*) *frit*, L., for 1882–1912, of which three generations occur in Central Russia, the first appearing in April and the second one in the second half of June, while in South Russia there are four, the last two appearing in July, August and September; *Eurygaster maroccana*, F., *E. maura*, F., and *E. integriceps*, Osh., for 1880–1913, which have one annual generation, the mature larvae hibernating; *Locusta* (*Pachytylus*) *migratoria*, L., for 1844–1913; *Calliptamus* (*Caloptenus*) *italicus*, L., for 1888–1913; and *Dociostaurus* (*Stauronotus*) *maroccanus*, Thunb., for 1901–1913.

AFANASSIEV (A. P.). **Русское виноградарство въ 1915 году. (I-й вегетаціонный періодъ).** [Russian viticulture in 1915. (The first vegetative period).]—**« Вѣстникъ Виноделія.»** [*Messenger of Viticulture*], *Odessa*, xxv, nos. 1–2 & 3–4, January–February and March–April 1916, pp. 36–52 & 111–141.

This is the first of a series of summaries of the reports received from local correspondents in the vine-growing districts of Russia, similar to those published in the previous year [see this *Review*, Ser. A, iii, p. 477, 602, and 701]. The first vegetative period was marked by a practical absence of outbreaks of insect pests, except in a few cases, when their numbers were negligible. In Bessarabia, *Rhynchites betulae* and *Clysia ambiguella* were reported from some places, good results being obtained against the last-named by spraying with "Galiatzin." *Eriophyes* (*Phytoptus*) sp. and *Pseudococcus vitis* were present in Kiev, frequent powdering with sulphur proving very effective against the latter. Caterpillars of *Aporia crataegi* caused damage amounting to 5 per cent. to some young vines in Cherson, where *Lethrus apterus*, *Epicometes* (*Tropinota*) *hirta* and *Eriophyes* were also reported in small numbers. In Taurida larvae of *Polyphylla fullo* did some damage to young plants. Against *Otiorrhynchus* handpicking was applied, but in the coast regions this could not be carried out, as the use of lanterns at night was not allowed for military reasons and consequently considerable damage was done. In the province of the Don the pests recorded were *Epicometis hirta*, *Lethrus apterus*, *Eriophyes* and *Melolontha*,

In some parts of Astrachan *Polychrosis* (*Eudemis*) *botrana* and *Eriophyes* (*Phytoptus*) *vitis* occurred, but were controlled with lead arsenate. Other records included :—Stavropol, *Melolontha*, *Clysia ambiguella*, *Otiorrhynchus* and *Eriophyes*; from Kuban, *Procris* (*Ino*) *ampelophaga*, which was controlled by handpicking, and *Eriophyes*, which chiefly attacks the Risling variety of grape; from Tchernomorsk (Black Sea), *Procris* and *Otiorrhynchus*, which were controlled by handpicking and spraying with barium chloride; from Tiflis, *Procris*, *Polyphylla fullo*, *Eriophyes*, *Phylloxera*, *Polychrosis botrana*, *Rhynchites betulae*, *Cecidomyia* sp., *Clysia ambiguella* and two species of Noctuids; from Dagestan, *Melolontha*.

VASSILIEV (Eugen). **Отъ Энтомологическаго Отдѣленія Энтомологической Станціи В. О. С. въ м. Смѣлѣ.** [From the Entomological Branch of the Entomological Station of the All Russian Society of Sugar Refiners in Smiela.]—**«Вѣстникъ Сахарной Промышленности.»** [*Herald of the Sugar Industry*], *Kiev*, no. 23, 18th June 1916, pp. 597–598.

A number of pests of sugar-beet were recorded during the first half of June. In the southern parts of Kiev and in Poltava and Charkov large numbers of *Phlyctaenodes sticticalis* were on the wing and a serious outbreak of the caterpillars is to be expected. In some localities the moths were caught on cloth sheets smeared with molasses and fixed to a long pole on wheels. They are also captured in troughs filled with fermenting molasses, particularly when these are situated near the ground, as the insects fly close to the soil. The author's view that the appearance of the adults of *P. sticticalis* coincides with the blossoming of *Robinia* is said to be confirmed. Several species of Noctuids, particularly *Feltia exclamationis*, were also caught in these troughs, as well as Elaterid beetles.

Положеніе о постоянныхъ земскихъ организаціяхъ (Бюро) по борьбѣ съ вредителями и болѣзнями сельско-хозяйственныхъ растеній Закавказья. [Regulations for the permanent local district-organisations (Bureaus) for the control of pests and diseases of crops in Transcaucasia.] Sine loco. (*Tiflis*?), 29th March 1916, 16 pp.

These regulations were approved by the Vice-regal Council of Caucasia and sanctioned by the Viceroy on the 29th March 1916. They provide for the establishment of Bureaus in Baku, Elisavetpol, Tiflis and Kutais, other Bureaus to be opened if and as required. Their work includes the organisation and conduct of campaigns against pests and diseases of crops, the distribution of information to the public and the staff of the local agricultural societies by means of lectures, classes, travelling museums, etc.; assisting them in obtaining apparatus and material necessary for the control of pests, by establishing hiring stations, etc.; the collection of data relating to pests and diseases and the framing of bye-laws for their control. Yearly conferences of the members of the stations with the staffs of the local agricultural societies are provided for, timed in such a way that the

local authorities should be able to consider their suggestions and recommendations in time for the required measures to be put into operation. The permanent Agronomical Council of the Ministry of Agriculture in Caucasia is to coordinate the work of the Bureaus with that of existing experimental and similar organisations. In accordance with local requirements each Bureau may have experts on Entomology, Zoology and Phytopathology. The general outlines of these regulations are contained in a report presented by B.P. Uvarov, which is printed as a supplement, as are also the minutes of the conference which decided upon them and a number of opinions from heads of many Entomological Stations and Bureaus in Russia, to whom the report had been submitted.

We are informed by B. P. Uvarov that three of the four projected Bureaus are already in existence, viz., in Tiflis, which is in his charge, his assistant being A. O. Fabrikant; in Elisavetpol, in charge of E. V. Jatzenkovsky and Z. S. Rodionov; and Baku, in charge of A. F. Radetzky and M. P. Kryshkevitch; no appointments have yet been made to the Bureau in Kutais.

RODZIANKO (V. N.). **О нѣкоторыхъ насѣкомыхъ, повреждающихъ древесныя насажденія въ Прибалтійскихъ губерніяхъ. Отчетъ о дѣятельности въ 1915 году.** [On certain insects, injuring tree plantations in the Baltic governments. Report on the work in 1915], *Petrograd*, 1916, 30 pp.

This is the second report of the Laboratory of Forest Entomology in Riga for the first half of 1915 and contains some data supplementary to the report for 1914 [see this *Review*, Ser. A, iii, p. 217]. Owing to the war, the Laboratory was removed from Riga in June 1915 and is now in Novgorod.

The following are the insects dealt with:—CURCULIONIDAE: *Hylobius abietis*, L., damaged the stems of pine-seedlings in one forest in Courland. In May and June 1915 the weevils were also found on some two- to five-year-old pine trees, the bark of the leading shoots of which was damaged. This pest should be controlled by removing stumps in the roots of which the larvae live, and collecting the adults by means of trap trenches, or baits of fresh pine bark. Spraying with milk of lime may also be useful before the beetles have injured the trees. *Pissodes notatus*, F., was also injurious in one forest of Courland, where it destroyed some small pine seedlings. *Rhynchaenus testaceus*, Müll. (*Orchestes scutellaris*, F.), damaged the foliage of various trees, especially those of *Alnus incana*. The adults of *Magdalis duplicata*, Germ., were found in May 1914 and June 1915 near Riga, on the shoots of young pines. The larvae of *Brachonyx pineti*, Payk. (*indigena*, Hbst.), live inside the young needles of pines, pupation taking place within the needle. The weevils hibernate and oviposit in May, the next generation appearing in the middle of the summer. *Strophosomus capitatus*, De G., (*obesus* Marsh.) was found in forests near Riga, mostly on pines, the young needles of which they injure. They were also found on *Betula verrucosa* destroying the young leaves. *Brachyderes incanus*, L., also feeds on pine-needles, small cavities being eaten out at the tips. The tubes formed by *Apoderus coryli*, L., were found on *Alnus incana*, *Corylus avellana* and *Betula pubescens*, those of *Rhynchites betulae*, L.,

occurring on *Betula verrucosa* and *B. pubescens*. This species has also been found by the author in South Russia on pear trees. *Rhynchites populi*, L., was found damaging the foliage of *Populus tremula*.

Lepidoptera: *Lymantria monacha* occurs near Riga and outbreaks of this pest were expected in the forests of Courland, but these could not be visited as they were occupied by the Germans. Adults of *Panolis flammea*, Schiff. (*piniperda*, Panz.) were present near Riga in the second half of April. The older caterpillars in June chiefly feed on the old pine-needles and do not touch the young shoots. In the laboratory the caterpillars pupated between the 7th and 16th July, in a thin layer of sand, pine-needles, etc. The caterpillars of *Tortrix piceana*, L., in spring feed on the tips of the shoots of young pines, pupation also taking place there. The pupal stage in the laboratory lasted 10-14 days, the moths being on the wing in the second half of June and first half of July. The caterpillar of *Rhyacionia* (*Retinia*) *resinella*, L., hatches in June and eats into the pine shoots near the tip, in which it forms a cell from the resin. In this it hibernates and remains until the autumn of the following year, the cell increasing in size with the growth of the caterpillar. It then hibernates once more inside the cell, pupating in the following spring and producing adults in May. The cells of *R. resinella* are mostly found on young pines, and are usually situated on the lateral branches, rarely on the leaders. In rare cases, the buds above the cells wither in the spring of the second year; more frequently they are able to develop and produce young shoots which only wither in the spring before the emergence of the imago. In the forests of Courland the imagines were present in 1914 and absent in 1915, but in view of the biennial cycle of this moth they may be expected again in 1916. The damage done is not very important, as the leading shoots are rarely infested. *Rhyacionia duplana*, Hb., although present in the government of Livonia, was not found there by the author, who, however, met with this species in Kiev [see this *Review*, Ser. A, ii, p. 516.] The caterpillars of *R. turionana*, Hb., live and feed inside large terminal buds of young pines and hibernate and pupate in the spring inside the injured buds. The caterpillars of *R. buoliana*, Schiff., live at the end of pine branches and on the tips of young pines. They hatch in the second half of summer, hibernate, and continue their development during the spring of the next year; they feed mostly on the large terminal buds and afterwards on the young shoots. They prepare cells from the injured buds and shoots, mixed with web and resin, sometimes several individuals forming a common nest, in which they pupate. The adults are on the wing in June and July. The injury caused by this species involves the destruction of great numbers of buds and young shoots. Near Riga, the caterpillars of *R. buoliana* were found in the male inflorescences on more or less tall trees, where they matured and pupated. This fact would tend to minimise the value of the usual remedy, which consists of removing and destroying the nests, in cases where tall pines, flowering in May, are present near nurseries or young plantations. The caterpillars of *Eucosma tedella*, Clerck, infest fir needles. Only one generation occurs during the summer, the caterpillars hibernating and pupating in the next spring. The adults were observed in large numbers in some forests in Livonia. Although this species was recorded as a pest of firs more than 100 years ago, its importance at the present time is

not regarded as great. Spraying may tend to check this moth in nurseries or parks, but is impracticable in forests. The caterpillars of *Cydia (Grapholitha) strobilella*, L., live and feed in fir-cones, in which they winter, pupating in the next spring. In the Baltic provinces, fir-cones are also attacked by *Dioryctria abietella*, Schiff.

Novikov (M.). **Культура мандариновъ въ Сочинскомъ округѣ.** [The cultivation of mandarins in the district of Sotchy (Black Sea coast, Caucasia).] — **« Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxvii, no. 4–5, April–May 1916, pp. 181–198.

Mandarin oranges in Caucasia suffer seriously from the attacks of scale-insects, against which sprays of soap-kerosene emulsion and tobacco extract should be used. The plants with dense heads, preventing the free circulation of air and sun, are more infested than those which are properly pruned.

Uvarov (B. P.). **Очерки по борьбѣ съ саранчевыми.** [Essay on the campaign against locusts.] — **« Сельское Хозяйство и Лѣсоводство.»** [*Journal of Agriculture and Forestry*], *Petrograd*, ccli, no. 5, May 1916, pp. 31–47.

This is a continuation of a series of articles on locusts by the same author [see this *Review*, A, iii, p. 437]; in this one he deals with the details of the organisation of the campaign. Mechanical methods of control, requiring a large number of labourers, are usually organised by means of forced labour, the whole population of a certain district being obliged to take part in it. Thus, in 1912 the population of the provinces of Syr-Darya, Samarkand and Ferghana supplied over five million working days in combating locusts. This method of compulsion leads to very inefficient work, a disadvantage which disappears with the introduction of the chemical method, which it is quite practicable to organise on the basis of paid labour. The author also advocates the centralisation of the campaign against locusts in the hands of the Central Government, the closer connection between entomological organisations in different localities, and the creation of special local funds for this object.

Uvarov (B. P.). **Новыя кавказскія прямокрылыя изъ сборовъ Н. А. Сатунина.** [New Caucasian Orthoptera from the collections of K. A. Satunin.]— **« Извѣстія Кавказскаго Музея.»** [*Bulletins of the Caucasian Museum*], *Tiflis*, x, no. 1, 1916, pp. 45–53.

A description is given of *Podisma satunini*, sp. n., *Phonochorion satunini*, gen. et sp. n., *Paradrymadusa satunini*, sp. n. and *Olynthoscelis satunini*, sp. n. Their economic importance is not stated.

Anutchin (A.). **Медвѣдка и мѣры борьбы съ ней.** [*Gryllotalpa gryllotalpa*, L., and its control.]— **« Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, xi, no. 9, 3rd May 1916, pp. 403–405.

G. gryllotalpa is stated to be useful to some extent in destroying larvae of *Melolontha*, but the damage done by it in fields and orchards

far outweighs this beneficial action. It occurs in Central and Southern Russia, chiefly in light, damp soil, near the surface. The only effective preventive remedy consists of placing sand, soaked with kerosene, on and around the plot to be protected; this must be repeated two or three times during the summer.

Ol (I. A.). **Мѣры борьбы съ грушевымъ пилильщикомъ.** [Remedies against *Hoplocampa brevis*, Klug.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 26, 9th July 1916, pp. 654–655.

The usual remedies against *Hoplocampa brevis* include the cultivation of the soil beneath the trees early in spring and the watering of pear-orchards in the first half of April in order to destroy the cocoons. The flower buds should be sprayed with a solution of soft soap and carbolic acid (3 lb. of soap and half a pint of carbolic acid in about 17 gallons of water). In April the trees may also be sprayed with lead arsenate or calcium arsenite.

Ol (I. A.). **О примѣненіи мышьяково- и мышьяковисто-кислаго натра въ борьбѣ съ насѣкомыми.** [The use of sodium arsenite and arsenate for the control of insect-pests.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 26, 9th July 1916, pp. 655–656.

In reply to a subscriber it is pointed out that the arsenite and arsenate of sodium are not suitable for controlling the caterpillars of *Hyponomeuta malinellus*, as they are very injurious to plants, and lead arsenate (Gypsin) or calcium arsenite should be used. The former can be prepared by dissolving in separate earthenware or glass vessels 11 oz. of chemically pure lead acetate and 4·5 oz. of pure sodium arsenite and mixing them together. Calcium arsenite is prepared as follows:—About 27 gallons of water, 10 lb. of white arsenic (in lumps) and 20 lb. of soda are put into a cast-iron boiler with a capacity of about 40 gallons and boiled until the arsenic dissolves, after which 3 or 4 lb. of quick lime is gradually added; the liquid is again boiled for about an hour and the whole made up to 200 gallons with water.

Balabanov (M. S.). **Культура табака и приготовленіе табачнаго экстракта для борьбы съ вредителями.** [The cultivation of tobacco and the preparation of tobacco-extract for the control of pests.]—**«Садовая Библіотека.»** [*Garden Library Series*], Supplement to **«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, 1916, 20 pp.

This paper deals with the cultivation of Machorka tobacco and gives a description of the preparation of tobacco extract on a large scale. Two sheet-iron tanks, each with a capacity of about 55 gallons, are

walled in with bricks, the chimney being preferably situated between them; each tank is provided with an iron pipe with a wooden tap near the bottom. About 6–8 lb. of ashes are put in each tank with about 55 lb. of tobacco leaves and the tanks are then filled with water. It is better to have a separate furnace for each tank. Heating is continued till the water boils, when the tanks are closed and the contents left till next day. About 35–40 gallons of extract are obtained from each tank, but for actual use it is diluted with two parts of water. Of this solution each apple or pear tree requires about from 1½ to 3 gallons, at a cost of about 1*d.* per tree. This insecticide is rendered more effective by adding a tumblerful of creoline to every 110–153 gallons of the solution.

SEVASTIANOV (I. A.). **Борьба съ кровяной тлей.** [The control of the woolly-aphis.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 6, June 1916, pp. 279–289, 9 figs.

This paper deals with the control of *Eriosoma lanigerum* much on the same lines as in a previous one [see this *Review*, Ser. A, ii, p. 75–77]. When there are no leaves on the trees, a soap-oil and a soda-oil emulsion can be applied, either by way of spraying or smearing. To prepare the emulsion for spraying purposes, ½–1 lb. of soda is dissolved in a small quantity of water, and ½–1 lb. of cotton-seed-, linseed-, hempseed-, or any other similar oil is added and the whole stirred with a bunch of twigs, water being added to bring the total volume to 3 gallons. The spraying must be done in autumn and the oily coating produced will protect the branches from becoming infested with this Aphid for two or three months. For smearing the trees, kerosene and cotton-seed or any similar oil are mixed in equal parts.

SAVTCHENKO (I.). **Изъ Мелитопольскаго уѣзда.** [From the district of Melitopol (govt. of Taurida).]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 6, June 1916, pp. 334–335.

Paris green (1½ oz. with quick lime, 4½ oz., in 27 gals. of water) was applied with success against *Cydia pomonella* in the spring. Owing to the increased price of tobacco, quassia emulsion was used against Aphids, prepared by boiling 4 lb. of quassia for about two hours in 8½ or 9 gals. of water; the decoction is left over night to settle and is then filtered; 3 lb. of soft soap dissolved in hot water are then added and water to make up a total bulk of 27–30 gals.

ERMAKOV (Prof. V. P.). **Вліяніе зимнихъ морозовъ на растенія.** [The influence of winter-frosts on plants.]—**«Садоводъ.»** [*The Horticulturist*], *Rosto-on-Don*, xv, no. 7, July, pp. 343–346.

This is a reiteration of a statement contained in a previous article [see this *Review*, Ser. A, iii, p. 486] that the injury to plants usually attributed to the effect of frosts is really caused by ants. In addition to bone-meal, manuring with superphosphate or basic slag tends to destroy these insects.

OSSIPOV (N.). **Борьба съ яблонной плодожоркой.** [The control of the codling-moth.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, No. 7, July 1916, pp. 368–372, 4 figs.

This is a short and popular account of the chief features of the life-history and control of *Cydia pomonella*, L., the usual remedies being discussed.

Новые инсектисиды и антисептическія вещества. [New insecticides and antiseptics.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, xv, no. 7, July 1916, pp. 385–386. [Reprinted from **«Сельскій Хозяинъ.»** (*The Husbandman*), no. 47, 1915.]

Kerosene emulsion usually consists of six parts of kerosene, one part of soap and 180 parts of water. Common soap may be replaced by the disinfectant soap obtained as a by-product in kerosene-refining, while instead of six parts of kerosene, which is highly volatile, it is better to use four parts of tar or wood-creosote and one part of a strong solution of salammoniac. An even better result is obtained with creosote extracted from coal with the addition of napthaline.

PEREZ (T. De Stefani). **Validità del metodo distruttivo contro l'insetto dei frutti del Pistacchio da me proposto.** [The efficiency of the destructive measure advised by me against the insect pest of the fruits of the pistachio.]—*L'Agricoltore Agrigentino, Girgenti*, viii, no. 3-4, March–April 1916, pp. 41-49.

Serious loss is caused to Sicilian growers by the injury done to *Pistacia vera* (pistachio) by the Chalcid, *Megastigmus* (*Trogocarpus*) *ballestrerii*. All infested fruit should be collected and burnt before June and July, as in these months the winged adults emerge from the damaged fruit and proceed to oviposit in those of the new crop. In plantations where this control has been practised for a few consecutive years, the loss has been reduced from 80 per cent. to 20 per cent. The fruits of the terebinth [*Pistachia terebintha*] are also attacked and must also be destroyed, or preferably the female inflorescences removed in April and May.

NOEL (P.). **Various insect pests.**—*Bull. Trim. Lab, Entom. Agric. Seine Infér., Rouen*, July–August–September 1916, pp. 3-16.

In a note on *Pegomyia nigritarsis* (*acetosae*) (sorrel fly) it is stated that the only means of control consists of removing and destroying all infested leaves before the larvae become mature and abandon the leaves in order to pupate in the ground.

Lists of insects attacking *Elymus*, *Syringa* (lilac), *Lathyrus*, *Aira* and *Lolium* are also given.

BENDER (E.). **La Psyché sur la vigne en Beaujolais.** [The Psychid on the vine in Beaujolais.]—*Progrès Agric. Vitic., Montpellier*, lxv (33rd year), no. 22, 28th May 1916, pp. 521–522.

The Psychid that is ordinarily a pest of grasses has occurred this year on the vine in Beaujolais, the first individuals being noticed at the end of April. Complete destruction by handpicking is not practicable owing to the difficulty of detecting the cases on account of their great resemblance to the vine bark.

TOPI (M.). **Sur les Traitements insecticides contre les Teignes de la Vigne: Traitements par l'eau chaude.** [Insecticide treatment against vine-moths: Hot water treatment.]—*Progrès Agric. Vitic., Montpellier*, lxv (33rd year), no. 24, 11th June 1916, pp. 563-566.

In experiments with the hot water treatment advocated by Semichon [see this *Review*, Ser. A, iv, p. 77] against the eggs of *Clysia ambiguella* and *Polychrosis botrana*, it appears that at temperatures which do not injure the vine—and water at 150° F. was found to scorch both young and old leaves—the eggs remain unaffected. To destroy them an immersion of 10 seconds in water of 150° F. or perhaps 131° F. was necessary.

MULLOT (G.). **Traitement arsenical contre le Négril de la luzerne.** [Arsenical treatment against *Colaspidema atrum*, Latr.]—*Progrès Agric. Vitic., Montpellier*, lxv (33rd year), no. 26, 25th June 1916, p. 609.

In a field of lucerne in Aude one-half of which was cut in the middle of May, *Colaspidema atrum*, Latr., appeared in the cut portion early in June. On the 8th June, 528 gals of a solution composed of 2 lb. sodium arsenate and 2 lb. lime in 100 gals. water, were sprayed in fine weather on the 17½ acres infested. Three days later the insects had disappeared.

CAUSSE (P.). **Le traitement de la Cochylis et de la Pyrale à l'eau chaude; le traitement du Court-Noué au goudron.** [The control of *Clysia ambiguella* and *Sparganothis pilleriana* with hot water and the treatment of short internodes with tar.]—*Rev. Vitic, Paris*, xliv, no. 1145, 8th June 1916, pp. 409-411.

Measures based on the experiments made by Semichon [see this *Review*, A, iv, p. 77] appear to have given good results in a vineyard containing 4,200 stocks. Instead of a sprayer, small jugs of 3½ pints capacity were used, the entire contents of one jug being poured on each stock. The bunches were first treated and then the remainder of the jugful was emptied on the leaves in order to destroy Pyralids. Scalding occurred at a temperature of 159° F., but at 150° F. no damage was done and all insects which came in contact with the water were killed. It was found that a woman could treat 300 stocks a day, the cost per acre, including labour and fuel being about 23 shillings.

VIALA (P.). **Le traitement de la Cochylis et de la Pyrale à l'eau chaude.** [The control of *Clysia ambiguella* and *Sparganothis* with hot water.]—*Rev. Vitic., Paris*, xliv, no. 1147, 22nd June 1916, pp. 440-442.

In commenting on the above report, the author states that in the south of France the use of hot water will probably be adopted against the first generation of *Clysia ambiguella* and *Polychrosis botrana* as well as against Pyralis [*Sparganothis pilleriana*], as at that period hot water poured by hand can easily reach the flowers. Should lead arsenate, however, again prove as efficient this year in the control of these insects as in the case of *Haltica*, it will be more economical.

Swaine (J. M.). **New Species of the Family Ipidae (Coleoptera). Part III.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 6, June 1916, pp. 181–192, 1 plate.

This systematic paper describes the following new Scolytidae:—*Pityokteines jasperi* from Alberta; *P. elegans* from Oregon and California, some individuals being taken on *Pinus monticola*; *Orthotomicus lasiocarpi*, abundant on *Abies lasiocarpa* in British Columbia and on *Larix americana* in Alberta; *O. ornatus* from Arizona, Oregon and California on *Pinus ponderosa* and *Pinus jeffreyi*; *Ips chagnoni*, abundant in Ontario and Quebec, chiefly on *Picea canadensis* and *Pinus strobus*, and extending southwards into New York State; *Ips vancouveri*, the type of which was taken on *Pinus monticola*, on Sitka spruce and western white pine in Vancouver Island and the coast of British Columbia and probably in the interior; *Leperisinus californicus*, which is allied to *L. aculeatus*, Say, was taken in California from living olive trees to which serious damage was being done.

Pests and Diseases of Cotton and their Control.—*Agric. News, Barbados*, xv, no. 368, 3rd June 1916, pp. 182–183.

The third day's proceedings of the West Indian Cotton Conference, held in March 1916 in St. Kitts, included a discussion on the pests and diseases of cotton. Importations from the United States might introduce the Mexican cotton boll weevil [*Anthonomus grandis*] into the West Indian Islands, though its importance there might perhaps not be so great as in the Southern States. The internal boll disease does not occur unless cotton-stainers [*Dysdercus*] or other bugs are present. In Barbados, where the stainers do not occur, the disease is associated with the green bug [*Nezara*]. Sudden invasions of the stainers in Antigua were said to have come from *Thespesia populnea* growing on the seashore. In Montserrat the same tree served as a food-supply, while at Nevis, after the cotton crop was gathered, stainers were seen on the physic nut tree [*Jatropha curcas*]. The control of cotton-stainers should therefore include the destruction of old cotton bushes and of the wild plants on which they feed in the absence of cotton.

The dispersal of leaf-blister mite of cotton.—*Agric. News, Barbados*, xv, no. 368, 3rd June 1916, p. 186.

In the West Indies the leaf-blister mite [*Eriophyes gossypii*] has been known as a pest of cotton since July 1903, when it made its first appearance in Montserrat. There seems to be no doubt that this mite lived upon some wild plant before the revival of the cotton industry, but this has not been proved by the discovery of such a plant. It appeared in all the islands of the Lesser Antilles very shortly after its first discovery, except in Barbados, where it was only discovered as late as 1912, though it had apparently existed there for some years previously. It has been supposed that birds, insects, and even the wind may be responsible for its distribution, and it has also been believed that transportation from place to place may have been effected on cotton seed. In 1914 microscopic observation showed that the full-grown mites had a tendency to ascend to the tips of leaf-hairs and assume

what appeared to be a waiting position. When a hair from a camel's hair brush was brought into contact with them, it was immediately grasped and the mite loosened its hold on the leaf-hair and allowed itself to be carried away. A mite could thus easily attach itself to an insect or bird. Early in 1916 a few cotton seeds were brought to Barbados from another island and planted in concrete tanks covered with cages of fine mesh wire. No cotton had been grown in these previously and no cotton is grown in the district. The first leaves of the plants from these seeds showed the characteristic signs of leaf-blister mite attack and there seems to be no possibility that the mites could have found their way to these plants except on the seed. The disinfection of all cotton seed used for planting in a solution of one part corrosive sublimate to 1,000 parts water is therefore recommended.

Runner (G. A.). **Effect of Röntgen Rays on the Tobacco or Cigarette Beetle and the Results of Experiments with a New Form of Röntgen Tube.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 11, 12th June 1916, pp. 383–388.

Under laboratory conditions tests made with a Röntgen-ray tube permitting a high-energy input and giving an intense and powerful radiation gave results which promise that the X-ray process may be successfully used in the treatment of cigars or tobacco infested with the cigarette beetle [*Lasioderma serricorne*]. In treating the egg-stage, heavier exposures are required to sterilise eggs which are near the hatching point than newly laid ones. A dosage equivalent to 150 milliampere minutes exposure with a spark gap of 5·5 inches gave satisfactory results with eggs in tobacco placed 7·5 inches from the focal spot of the tube. With this exposure the eggs in which embryonic development was well advanced hatched, but in all cases where these larvae were kept under observation, they failed to reach the adult stage. In two separate experiments adults were given an exposure of 600 milliampere minutes, with a spark gap of 5·5 inches, giving an approximate voltage of 65,000, with humidity at 57. The distance from the focal spot of the Röntgen tube was 7·5 inches. No effect on the length of life was apparent, as the beetles died at about the same rate as the same number of beetles kept as a control. Large numbers of eggs were deposited after exposure, but were infertile, though eggs from the control beetles hatched normally. Larvae were given an exposure of 600 milliampere minutes, other conditions of the experiment being the same as with the adults. While no immediate effect was apparent, the treatment had the effect of stopping activity and development, the larvae remaining in a dormant condition for a prolonged period. All treated larvae died before reaching the pupal stage.

Rand (F. V.) & Enlows (Ella M.A.). **Transmission and Control of Bacterial Wilt of Cucurbits.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 11, 12th June 1916, pp. 417–434, 2 plates, 3 figs.

In the experiments so far completed, the cucumber beetles, *Diabrotica vittata*, F., and *D. duodecimpunctata*, L., have been shown to be the most important, if not the only summer carriers of the wilt organism, *Bacillus tracheiphilus* [see this *Review*, Ser. A, iv, pp. 27 and

38], and at least one species, *D. vittata*, is capable of carrying the wilt over the winter and infecting spring cucumber plants. In these tests, *Anasa tristis* (squash bug), *Crepidodera cucumeris* (flea beetle), *Aphis gossypii* (melon aphis) and *Epilachna borealis* (twelve-spotted lady-beetle) failed to transmit the disease.

GOODWIN (W. H.). **The Grape-Berry Worm (*Polychrosis viteana*, Clemens).**—*Ohio Agric. Expt. Sta., Wooster*, Bull. no. 293, March 1916, pp. 259-307, 20 plates, 15 tables. [Received 5th July 1916.]

Polychrosis viteana is the most important pest of grapes in New York, Pennsylvania and Ohio, and is especially destructive in districts near Lake Erie, where the crop is seldom destroyed by frost during the blossoming period or later. In central and eastern Ohio, frost acts as a natural means of control every four or six years by destroying the flowers of the grape and, in consequence, the food of the larvae. In northern Ohio, winter is passed in the pupal stage within a cocoon protected by a folded leaf of the host plant. Adults emerge from the first or second week in June to the first week in July. Larvae developing from eggs laid on the buds, stems, and newly-formed berries, hatch in from four to eight days, and reach maturity in from 20 to 27 days. Pupation takes place within a folded leaf, and adults emerge in from 7 to 10 days. Adults of this brood appear from 5th to 12th August. The second generation of larvae matures in October or earlier; pupation takes place in fallen leaves which are fixed in the soil. Adults emerge in the following June and are active between 3 p.m. and dusk; the powers of flight are weak, but it is possible that they may be carried several miles by the wind.

Spraying experiments have shown that the larvae can be readily destroyed in the early stage. The first spray, consisting of 4 lb. lead arsenate, Bordeaux 2-3-50 [50 U.S. gals. water], and 2 lb. soft soap, should be applied just after flowering, when the largest berries are about one-eighth inch in diameter. The second spraying should be made between 3rd and 12th August, using the same materials as in the preceding case. A third spray, in which the amount of lead arsenate should be increased to 6 lb., should be applied about the time when the second generation larvae appear.

GILLANDERS (A. T.). **Forestry and the War.**—*Qtrly. Jl. Forestry, London*, x, no. 3, July 1916, pp. 200-209.

The present abnormal cutting of trees in Britain and the resulting increase in the amount of brushwood and the large proportion of stools is liable to produce a corresponding increase in the numbers of insect enemies of forest trees, especially weevils and bark-beetles belonging to the family SCOLYTIDAE. *Hylobius abietis* (pine weevil), which is given as an example of the former, attacks the bark and cambium of young Coniferous trees from four to seven years old. The most serious injury is caused by the adult and can therefore be reduced to a considerable extent by the collection of the weevils. The larva is capable of living in the roots of recently felled trees for some time. The best method of control is the burning of all waste material, followed by stocking the land for three or four years with cattle or sheep. Similar measures should be undertaken against *Hylurgus piniperda* (pine eetle).

TOWER (D. G.). **Comparative Study of the Amount of Food eaten by Parasitized and Nonparasitized Larvae of** *Cirphis unipuncta*.—*Jl. Agric. Research, Washington, D.C.*, vi, no. 12, 19th June 1916, pp. 455–458, 1 table.

Larvae of *Cirphis unipuncta*, Haw., which were parasitised by *Apanteles militaris*, Say, were fed on portions of leaves of maize of a known area. The amount consumed was compared with that eaten by healthy larvae as determined by Davis and Satterthwait. The results showed that during the last three instars the parasitised larvae require about half as much food as the non-parasitised during the same period. The duration of the life-cycle of the parasite within the host was practically constant, although the age of the larvae in which oviposition took place varied considerably.

QUAINTANCE (A. L.) & BAKER (A. C.). **Aleurodidae or White Flies attacking the Orange, with Descriptions of Three New Species of Economic Importance.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 12, 19th June 1916, pp. 459–472, 3 figs., 6 plates, 2 tables.

This paper summarises the known species of whiteflies attacking citrus trees. They comprise :—*Aleurocanthus citriperdus*, sp. n., from Ceylon on an undetermined tree, and from India and Java on *Citrus* sp. and orange ; *A. woglumi*, Ashby, here described for the first time, occurring on orange in India, Ceylon and Jamaica, as well as on other species of *Citrus*, *Capparis* spp., *Salacia reticulata*, etc. ; *A. citricolus*, Newst., on *Citrus* sp. from East Africa ; *A. spiniferus*, Quaint., on orange from south China and on Citrus sp. and rose from Java ; *Aleurolobius marlatti*, Quaint., on orange from Japan, *Citrus* sp. and *Morus* sp. from Lahore, *Ficus* sp. from Ceylon and on an undetermined plant from Java ; *Aleurothrixus porteri*, sp. n., from Chile and Brazil on a variety of food-plants, including orange ; *A. floccosus*, Mask., from the West Indies, Florida, Mexico, British Guiana, Brazil, Chile, etc., on orange, lime, grapefruit, guava, *Plumeria* sp., *Baccharis genistelloides*, etc. ; *A. howardi*, Quaint., having the same distribution and hosts as the preceding species ; *Bemisia giffardi*, Kotin., on *Citrus* sp. in Honolulu and on an undetermined tree in Lahore ; *Dialeurodes citri*, Ashm., on *Citrus* spp., *Melia azedarach*, *Gardenia jasminoides*, *Coffea arabica*, *Ficus nitida*, etc., from India, Ceylon, Japan, China, Chile, Mexico, Brazil and Florida ; *D. citrifolii*, Morg., on *Citrus* spp. from North Carolina, Mississippi, Louisiana, California and Florida, and *Ficus nitida* from New Orleans ; *Paraleurodes perseae*, Quaint., on orange, *Persea americana* and possibly *Diospyros* spp., from Florida ; *Trialeurodes floridensis*, Quaint., on avocado, orange, guava and *Anona squamosa* from Florida ; *T. vitrinellus*, Ckll., on orange from Mexico and oak from South California ; *Tetraleurodes mori*, Quaint., on orange and a variety of other plants in the eastern United States ; *T. mori* var. *arizonensis*, Ckll., on orange from Arizona and Mexico.

DICKERSON (E. L.) & WEISS (H. B.). **Notes on** *Leptoypha mutica*, **Say (Hemip.).**—*Entom. News, Philadelphia*, xxvii, no. 7, July 1916, pp. 308–310, 1 plate.

The Tingid bug, *Leptoypha mutica*, Say, is recorded on *Chionanthus virginica*, L., at Hammonton, New Jersey, where considerable injury

has been caused during the past few years. The insect feeds by sucking the sap from the under-surface of the leaves, causing a whitish or yellowish-brown discoloration, of the complete withering of the leaf in severe cases. Where the host plant is shaded, feeding may also take place on the upper surface of the leaf. Adults and nymphs were found between 7th July and 1st September; there may be two generations annually and hibernation may take place in the adult stage.

GREEN (E. E.). **On some Animal Pests of the Hevea Rubber Tree.**—*Reprint from Trans. 3rd International Congress Trop. Agric., London*, 1916, pp. 608–636. [Received 14th July 1916.]

Insect pests of hevea rubber [*Hevea braziliensis*] include :—

Orthoptera: *Aularches militaris* (spotted locust) may appear in injurious numbers in certain parts of Ceylon and cause the partial defoliation of young rubber trees. The habit of the adults of congregating in large numbers for the purpose of egg-laying renders their capture easy. The ground beneath should then be broken up to a depth of six inches and covered with quick-lime. *Tropidacris cristata* is destructive to foliage in British Guiana, and *Zonocerus elegans* and *Z. variegatus* attack the trees in a similar way in the Belgian Congo. In the Straits Settlements *Brachytrypes achatinus*, *Gymnogryllus elegans* and *Cyrtacanthacris* sp. bite through the stems and twigs of seedlings and carry the shoots into their burrows. In Java *Cleandrus* sp. may split young stems for purposes of oviposition.

Termites are not serious pests of rubber in Ceylon, the following species having been occasionally met with :—*Termes horni*, *T. obscuriceps*, *T. redemanni* and *Eutermes inanis*. *Coptotermes* (*T.*) *gestroi* is important in Borneo, Java and Sumatra, where it attacks the heartwood of living trees, which are then liable to be broken off by wind. *C. marabitanos* in Brazil is said to attack the areas of wood exposed by tapping.

Among the Hymenoptera, small bees and wasps frequently tunnel in the ends of stumped plants, the cut ends of which have died back as far as the node below. This condition can be remedied by stumping the plant about half an inch above the node.

Several Coleopterous pests are known. A Melolonthid, *Lepidiota pinguis*, attacks the roots of hevea rubber, coffee and cinnamon in Ceylon in the larval stage, injury being mainly confined to young plants. The use of nitrate of soda or vaporite is recommended for controlling this species. A Rutelid, *Cingala tenella*, injures the foliage of young plants to some extent. A species of *Xylotrupes* has a similar habit in the Malay States, but with more serious results. The Longicorn, *Batocera rubus*, has recently become a pest of hevea rubber in Ceylon. Injury may take the form of a hollowing out of the tap root or the destruction of the bark and wood at, or below the surface of the soil. The normal method of entry of the larva is probably through diseased areas in the bark. Methods of control include the collection of adults, the removal of diseased parts and the tarring of exposed surfaces. *Maechotypa verrucicollis* and *Niphona* sp. have been recorded as feeding on the bark of young trees. Species of CURCULIONIDAE which are occasionally injurious are, *Astycus chrysochlorus* and *Hypomeces squamosus* in Malaya; *Dereodes curtus* and *Phytoscaphus*

sp. in Java; and *Ischnotrachelus humeralis, Blosyrus seminitidus, Isaniris* sp. and *Piezotrachelus* sp. in the Belgian Congo. Shot-hole borers (BOSTRYCHIDAE and SCOLYTIDAE) associated with rubber include *Xylopertha mutilata, Xyleborus ambasius, X. affinis, X. camerunus, X. cognatus, X. confusus, X. discolor, X. interjectus, X. morigerus, X. obliquicauda, X. parvulus, X. perforans, X. semigranosus, X. semiopacus, X. submarginatus, Cryphalus plumieriae, C. congonus, C. heveae, C. tuberculosus, Platypus solidus, Eccoptopterus sexspinosus, Phloeotribus puncticollis* and *Coccotrypes* sp.

Lepidoptera feeding on the foliage are:—the Saturniids, *Attacus atlas* and *Antheraea paphia*; the Limacodid, *Thosea* sp.; the Lymantrid, *Orgyia postica*; the Psychid, *Clania variegata*; the Noctuid, *Euxoa (Agrotis) segetum*; the Tineid, *Comocritis pieria*, and the Cossid, *Arbela quadrinotata*.

Pests among the Rhynchota include the Coreid, *Leptocorisa acuta*, and the Capsid, *Calicratides rama*, in Ceylon; the Pentatomid, *Empicoris variolosus* in British Guiana; and the Coccids, *Aspidiotus destructor, A. transparens, Chrysomphalus aonidum (A. ficus), C. (A.) personatus, Asterolecanium pustulans, A. pustulans seychellarum, Pseudococcus virgatus, Mytilaspis rubrovittatus, Parlatoria proteus, Chionaspis dilatata, Saissetia (Lecanium) nigra* and *Vinsonia stellifera*.

THEOBALD (F. V.). **Notes on New and Little Known British Aphides. Part II.**—*Entomologist, London,* xlix, no. 638, July 1916, pp. 145–149, 2 figs.

The following Aphids from south-east England are described:—*Macrosiphum hibernaculorum*, Fonsc., on a species of *Daphne*; *M. piceaella*, sp. n., on *Picea excelsa*; and *Rhopalosiphum tulipaeella*, sp. n., on cultivated tulips and violets.

PHILLIPS (E. F.). **Professor Gossard's Theory on Fireblight Transmission.**—*Jl. Econ. Entom., Concord,* ix, no. 3, June 1916, pp. 362–363.

The theory that bees may be concerned in the transmission of fireblight [see this *Review*, Ser. A, iv, p. 187] is criticised on the ground that it is not supported by experimental data. There is no proof that the bacteria enter the hive, and the latter cannot therefore be regarded as a centre of distribution. Further evidence is needed as to the relative importance of flying insects and Aphids in spreading the disease. The author suggests the desirability of attempting to isolate *Bacillus amylovorus* from the mouth-parts of bees as they leave the hive.

HOLLAND (E. B.). **Detection of Arsenic in Bees.**—*Jl. Econ. Entom., Concord,* ix, no. 3, June 1916, pp. 364–366.

The experiments described in this paper were undertaken in consequence of the high mortality which has occurred during recent years in apiaries in Massachusetts. The assumption that death was due to arsenic poisoning was borne out to a considerable degree by chemical examination. Traces of arsenic were found in 12 out of 23 samples submitted and also in stored pollen. Further investigations are being carried out to determine the amount of arsenic present in the samples.

FINK (D. E.). **Injury to Peanuts by the Twelve-Spotted Cucumber Beetle** (*Diabrotica 12-punctata*, **Ol.**)—*Jl. Econ. Entom.*, *Concord*, ix, no. 3, June 1916, pp. 366–368, 1 plate.

Peanuts in Virginia are frequently attacked by *Diabrotica* 12-*punctata*. The larvae of this beetle bore into the young, soft pods and completely destroy the nut within. Pods which are approaching or have reached maturity are seldom attacked. Examination of two plots showed that one on which peanuts had been growing for several consecutive years was injured to the extent of 47 per cent., while the other, on which peanuts had been grown in rotation every three years with maize or potatoes, was injured only to the extent of 24 per cent. Vigorous growth and crop rotation are important factors in controlling this insect. So far as is known, the larvae do not attack cowpeas, clover, potatoes, cabbage, spinach, kale, turnips, tobacco or egg-plants. Cereal crops are not recommended for alternation with peanuts.

ESSIG (E. O.). **A Coccid-Feeding Moth,** *Holcocera iceryaeella*, **Riley** (*Blastobasis iceryaeella*, **Riley**).—*Jl. Econ. Entom.*, *Concord*, ix, no. 3, June 1916, pp. 369–370, 1 plate.

Hibernating larvae of *Holcocera iceryaeella* were found during the winter of 1914 beneath the old shells of *Eulecanium* (*Lecanium*) *persicae*, F. (European peach scale), at Berkeley, California. Later observations showed that the larvae fed on old shells, eggs and young of this scale, but did not appear to attack scales which were more than half-grown. Large numbers were found on *Laurus nobilis*, L. (sweet bay) infested with *Aspidiotus camelliae*, Sign. (greedy scale), but did not apparently act as a check upon this insect. Other scales attacked by *H. iceryaeella* are:—*Saissetia oleae*, Bern. (black scale), *Icerya purchasi*, Mask. (cottony cushion scale), and *Pseudococcus bakeri*, Essig (Baker's mealy bug). The larvae spin protective webs over the areas infested by the scale-insects, the larval and pupal stages being passed through in these situations.

CORY (E. N.). **Notes on** *Pegomyia hyoscyami*, **Panz.**—*Jl. Econ. Entom.*, *Concord*, ix, no. 3, June 1916, pp. 372–375, 1 fig.

Pegomyia hyoscyami, Panz., has been reared from spinach, *Chenopodium album* and *Amaranthus retroflexus*. The eggs are deposited on *C. album* in rows on the under-surface of the leaves. In 1915 the first eggs were observed on 15th May. The incubation period is four days. In 1912, nearly full-grown larvae were present in spinach leaves on 17th May and produced adults between 5th and 19th June. In 1915, larvae were present until the first week in August; they then disappeared and a new generation was produced in September. There are at least three broods annually. The pupal stage was found to vary between 14 and 20 days. The entire life-cycle occupied from 30 to 42 days, with an average of 32 days. The parasite *Opius foveolatus*, Ashm., has been reared from this fly.

FLINT (W. P.). **An Egg Parasite of the Army-worm** (*Heliophila unipuncta*).—*Jl. Econ. Entom., Concord*, ix, no. 3, June 1916, p. 377.

A severe outbreak of *Cirphis* (*Heliophila*) *unipuncta* (army-worm) occurred in southern and central Illinois during the spring of 1914. Adults of the first generation were abundant in June, but hardly any moths of the second generation were seen during the end of June and July. The same conditions were observed during the following year. Investigation of eggs kept in captivity showed the presence of a Chalcid parasite, a species of *Telenomus*, which was responsible for the destruction of 79 per cent. of the eggs.

WEISS (H. B.). *Gonepteryx rhamni*, **Linn., and** *Castnia therapon*, **Koll., in New Jersey.**—*Jl. Econ. Entom., Concord*, ix, no. 3, June 1916, p. 378.

A female specimen of *Gonepteryx rhamni*, L., was obtained from *Cotoneaster microphylla* imported from France. *Castnia therapon*, Koll., was found in the rhizomes of greenhouse orchids, causing considerable damage. The host plants were obtained originally from Pernambuco and were probably infested at the time of arrival. This moth is a native of Brazil, where the larva feeds on *Oncidium crispum* and *Catasetum* sp.

MCCRAY (A. H.). **Report of the Finding of American Foulbrood and European Foulbrood in the same Bee Comb.**—*Jl. Econ. Entom., Concord*, ix, no. 3, June 1916, p. 379.

The presence of American and European foulbrood in the same comb was detected in a sample received from Stanislaus County, California. The former was recognised by the typical scales adhering to the lower cell wall, by the spores of *Bacillus larvae*, and by the characteristic odour, the latter by the grey, yellow and brown coloration of the larvae and by the presence of *B. pluton*. Spores of *B. alvei* were also found.

MÜLLER (P.). **Schädlingsbekämpfung; Borkenkäfer.** [Pest control; bark-beetles.]—*Schweiz. Zeitschr. Obst- u. Weinbau, Frauenfeld*, xxv, no. 13–14, 12th July 1916, p. 202.

To control bark-beetles in fruit trees, the author injected carbon bisulphide into the holes, which were then closed with wooden plugs. The trees were then painted with whitewash containing 10 per cent. of carbolineum, and manured with liquid manure. The result was completely successful.

CHAMBERS (F.). **A Defence against Weevils.**—*Rhodesia Agric. Jl., Salisbury*, xiii, no. 3, June 1916, pp. 397–398.

A native method of protecting maize against weevils consists of mixing the grain with finely powdered wood ashes before storing and afterwards coating the outside of the sacks with fresh cow dung. A layer of wood ashes on the outside of the sacks only is very effective. In an editorial note it is stated that a layer of building lime on the floor of the storing place and between the successive layers of bags also gives satisfactory results.

JOHNSON (C. W.). **Parasites of *Archips cerasivorana*, Fitch.**—*Pysche*, *Boston, Mass*, xxiii, no. 3, June 1916, p. 81.

The following parasites were reared from the Tortricid, *Cacoecia* (*Archips*) *cerasivorana*, the webs of which were collected during June 1915:—Diptera: *Dichoetoneura leucoptera*, Johns., and *Neopales tortricis*, Coq. Hymenoptera: *Bassus agilis*, Cress., and *Labrorychus prismaticus*, Nort. *Pimpla* (*Itoplectis*) *conquisitor*, Say, was reared from nests obtained during the previous year.

DEAN (W. S.). **Manufacturing Tests of Cotton fumigated with Hydrocyanic-Acid Gas.**—*U.S. Dept. Agric.*, *Washington, D.C.*, Bull. no. 366, 24th April 1916, 12 pp., 9 tables. [Received 21st July 1916.]

Tests with cotton which had been fumigated with hydrocyanic acid gas for the destruction of the pink boll worm [*Gelechia gossypiella*] showed that this treatment does not affect to any material extent the spinning qualities, tensile strength, bleaching, dyeing or mercerising properties of the cotton.

CHITTENDEN (F. H.). **The Rose-Chafer: a Destructive Garden and Vineyard Pest.**—*U.S. Dept. Agric.*, *Washington, D.C.*, Farmers' Bull. no. 721, 28th April 1916, 8 pp. 4 figs. [Received 21st July 1916.]

Macrodactylus subspinosus, F. (rose chafer) is very injurious in the eastern parts of the United States, and occurs less commonly in Canada and westward to Oklahoma and Colorado. The food-plants are extremely varied, including fruit and shade trees, shrubs, vegetables and grasses. The roots and all aerial portions except the stems of the hosts are attacked. Adults emerge from the ground during June, and after pairing, the female deposits singly from 24 to 36 eggs a few inches below the surface of the soil. Feeding on flowers, leaves and fruit takes place throughout the adult stage, which lasts about three weeks. The larvae, which hatch in two or three weeks, feed mainly on the roots of grasses until autumn, when they go down more deeply into the soil for hibernation. Pupation occurs in April or May; the duration of this stage is from two to four weeks. Control measures include hand-picking and the use of arsenicals against the adults, and the destruction by ploughing, etc., of larvae and pupae. This operation should be carried out in the latitude of northern Ohio between 25th May and 10th June. Early-flowering plants, such as spiraea, magnolia, white roses, etc., serve to attract the beetles from the main crop. The arsenical recommended is 4 or 5 lb. lead arsenate paste in 50 U.S. gals. water, or Bordeaux mixture or lime-sulphur.

The Mally Fruit Fly Remedy.—*Union of S. Africa. Dept. Agric.*, *Pretoria*, Div. Entom. Bull. no. 83. 1915, 8 pp., 1 plate, 2 figs. [Received 19th July 1916.]

This bulletin describes the Mally fruit fly poison bait [see this *Review*, Ser. A, i, p. 195; ii, p. 706] and the method of its application for the prevention of maggots in fruit by the destruction of the adult flies before

oviposition. The formula given is :—Sugar, 2½ lb. or 25 lb.; arsenate of lead paste, 3 oz. or 2 lb.; water 4 gals. or 40 gals. The lesser quantities are for a paraffin tin, the larger for a barrel. The arsenate should be thoroughly mixed with a small quantity of water and then stirred into the bulk. The sugar may be poured into the full amount of water and stirred until dissolved. Rainwater should be used. Made in this way, the bait does not attract bees to an appreciable extent, but house-flies and a number of other species are poisoned by it. An ordinary garden syringe is the best means of distributing this bait.

GUNN (D.). **The Pepper Tree Caterpillar,** *Bombycomorpha pallida*, **Dist.** —*Union of S. Africa. Dept. Agric., Pretoria*, Div. Entom. Bull. no. 5, 1916, 10 pp., 10 figs. [Received 19th July 1916.]

During recent summers, a large number of pepper trees have been defoliated in Pretoria and the neighbourhood by the Lasiocampid, *Bombycomorpha pallida*, Dist. Owing to the proximity of these shade-trees to houses and the wandering habits of the mature larvae, this insect is often a household nuisance. A description of the various stages is given. In Pretoria the cocoons of the first brood are found in December, the moths appearing at the end of January; those of the second occur between April and June, the adults appearing about mid-October. The large green Mantid, *Sphodromantis gastrica*, Stål, was observed to devour the larvae. Some of these Mantids, which had destroyed all the larvae on the pepper trees under observation, were removed to another infested tree two miles away and within ten days every larva was destroyed. The Pentatomid bug, *Glypsus conspicuus*, Westw., is another important predaceous enemy. The Tachinid, *Argyrophylax bimaculata*, Hart., is a parasite of this species, and of several hundred cocoons examined, about 30 per cent. first generation and 40 per cent. second generation larvae were found to be attacked. To control the larvae, infested branches may be cut off and the insects either crushed or placed in hot water or in paraffin and water. A spray containing 3 lb. of lead arsenate to 50 gals. of water will effectively kill the larvae if applied to the foliage. If powdered arsenate of lead is used, 1½ lb. to 50 gals. water is sufficient. When a heavy infestation occurs and a large number of trees have to be sprayed, Paris green will be found cheaper; the best formula tried contained 10 oz. of Paris green in 50 gals. of water, to which 1 lb. of unslaked lime is added. Before spraying, the mixture should be thoroughly stirred and kept agitated at frequent intervals during operations. Thousands of larvae have been caught by bands of cheap canvas or other material being placed round the trunks of pepper and neighbouring trees. The bands should be at least a foot in width and should be attached 2 or 3 feet from the ground. The larvae should be removed from underneath the bands two or three times a week [see also this *Review*, Ser. A, i, p. 12, and ii, p. 653].

GUNN (D.). **The Potato Ladybird Beetle,** *Epilachna dregei*.—*Union of S. Africa. Dept. Agric., Pretoria*, Div. Entom. Bull. no. 6, 1916, 7 pp., 6 figs. [Received 19th July 1916.]

The potato is the favourite food-plant of *Epilachna dregei*, which appears to be increasing in importance as a pest. The various stages

are described. The complete life-history averages 49 days. The eggs are deposited in clusters on the under-surface of leaves and under field conditions were first observed during the last week of October. The larvae feed upon the lower epidermis of the leaves only, whereas the adults almost invariably feed upon the upper. In the insectary the larvae nearly always pupated on the soil, but under natural conditions they do so in sheltered spots on their food-plants. In Pretoria and in the neighbourhood of Johannesburg two generations were observed during the season. The eggs of the first were deposited on 30th October 1914 and the adults emerged on 26th December. Those of the second generation were deposited on 11th January 1915 and the adults emerged on 28th February. *E. dregei* is distributed all over the Union of South Africa and also occurs in Rhodesia. The food-plants include the potato, pumpkin, vegetable marrow, cucumber, turnip, radish, melon, bean, spinach and wild Solanaceae. The injury is caused by the larvae and adults consuming the leaf-tissue, the chief damage being undoubtedly caused by the former. On one farm nearly 15 acres of potatoes were destroyed. The beetles hibernate during the winter and early spring under the bark of eucalyptus trees, stones, and rubbish near gardens and potato fields. It was found easy to control both larvae and adults owing to their sluggish habits and their tendency to remain on particular leaves until these have been entirely skeletonised. It is essential that spraying should be begun directly the larvae are observed on potato foliage, as they are markedly gregarious for the first two weeks. A spray containing 3 lb. of lead arsenate paste to 50 gals. water is efficient, but care must be taken to spray both the upper and lower surfaces of the leaves. For large areas, where economy is a consideration, an excellent substitute consists of 1 lb. Paris green to 100 gals. water, to which 2 lb. unslaked lime is added.

GUNN (D.). **The Plum Slug Caterpillar,** *Parasa latistriga*.—*Union S. Africa. Dept. Agric., Pretoria*, Div. Entom. Bull. no. 7, 1916. 7 pp., 4 figs. [Received 19th July 1916.]

The dark brown, oval cocoons of the Limacodid, *Parasa latistriga* (plum slug caterpillar) are common on the leafless deciduous fruit and oak trees of Pretoria, being found on apple, peach, plum, nectarine, apricot, oak and sycamore. The chief injury is done to plum and oak trees. This species may have an even wider range of food-plants, especially as it occurs in other parts of South Africa. The various stages are described. The life-cycle of the first generation of *P. latistriga* averages 93 days, the second occupying about nine months. The larva is compared in detail with that of *P. johannes*, which closely resembles it and is also a pest of oak trees. During November and December several parasites emerged from cocoons in the insectary, but as only 3 per cent. were parasitised, this natural control is not important. A spray containing 3 lb. of lead arsenate paste to 50 gals. of water readily destroys the larvae, provided care is taken to spray the under side of the leaves thoroughly, and should be employed before the larvae have abandoned their gregarious habits. Paris green in the proportion of 1 lb. to 80 gals. of water, to which 1 lb. of unslaked lime is added, is an excellent substitute for arsenate of lead paste where economy is necessary.

GUNN (D.). **I. Some Destructive Fruit and Flower Beetles. II. A New Insect Pest of the Peach.**—*Union of S. Africa. Dept. Agric., Pretoria*, Div. Entom. Bull. no. 8, 1916, 8 pp. 2 figs. [Received 19th July 1916.]

Section I. of this Bulletin deals with the Cetoniids, that injure cultivated flowers and fruit in many parts of South Africa during the summer. Peaches suffer most from their attack, from 20 to 50 per cent. of the peach crop near Pretoria being damaged. The beetles first appear on early varieties of peaches towards the end of November, and are present in large numbers until the middle of February, when their numbers gradually begin to decrease. Other food-plants include pears, plums, nectarines, apricots, figs, grape-vine foliage, orange-blossoms and *Acacia horrida* (wild thorn). The different species of *Acacia* are apparently the native food-plants. The following species were abundant in Pretoria during the summer of 1913-14: *Rhabdotis aulica*, *Pachnoda impressa*, *P. cincta*, *P. carmelita*, *Heterorrhina flavomaculata*, *Plaesiorrhina recurva* var. *plana*, *Oxythyrea margarita* and *O. dysenterica*. As many as fifteen beetles of different species were frequently seen feeding on a single peach, and over five hundred were counted on one peach tree. The life-history of these beetles is believed to be similar to that of the cockchafers or May-beetles, and from one to two years may be spent in the soil in the larval and pupal stages before the adults emerge in the early part of the summer. Only a few beetles were caught in the course of tests with odorous oils, such as paraffin, eucalyptus and oil of citronella. From an experiment made with the object of discovering whether the beetles hibernate in the winter, it seems probable that the females deposit their eggs at the end of the season and then die. As the beetles invariably attack ripe or nearly ripe fruit, an arsenical spray, if used sufficiently strong to destroy them, would be dangerous. Collection is a practical remedy, but as the beetles are easily disturbed, precautionary measures have to be adopted, as their flight is very swift. A butterfly net made of stout wire and cheesecloth, of 18 inches in diameter, mounted on a 5-foot pole, was found to be the best for this purpose. This is placed under the branches and the beetles, when disturbed, drop into it. As many as 150 were caught at one time in this manner. Cloths placed under the tree and butterfly nets of larger diameter (three feet) did not give such good results. The captured beetles should be killed by dropping them into a tin containing 1 part of paraffin to 8 of water. By adopting this method in the summer months from mid-November to mid-February, all injury to fruit can be prevented.

Section II. deals briefly with the Longicorn, *Philagathes laetus*, a new insect enemy of the peach, which it damages in conjunction with the Cetoniids. It was first seen in mid-December and continued to injure early varieties until mid-January. Only ripening or ripened fruits suffer. This pest is likely to escape notice, as it has the habit of burrowing into the fruit until only the end of the abdomen is visible. It is sluggish when feeding and not so easily disturbed as the Cetoniid beetles. It has also been recorded from Buluwayo, Rhodesia. As nothing is known of its life-history, no remedy can be suggested against the early stages. The adults can be easily caught and destroyed in the same manner as the Cetoniid beetles.

GUNN (D.). **The Cucumber and Vegetable Marrow Fly,** *Dacus vertebratus.*—*Union of S. Africa. Dept. Agric. Pretoria,* Div. Entom. Bull. no. 9, 1916, 6 pp. [Received 19th July 1916.]

The Trypetid fly, *Dacus vertebratus*, has been an important pest for many years in most parts of the Union of South Africa where cucumbers, vegetable marrows, pumpkins or water-melons are grown, and in many gardens the cultivation of these plants has had to be abandoned owing to its presence. The eggs are deposited in the rind of Cucurbitaceous fruits at a depth of about 2 mm., chiefly on the lower side of the fruit. The number of generations was not ascertained, but egg-laying was found to be continuous throughout the summer. The period of incubation varies, occupying from 2 to 4 days in the insectary. The larva possesses two large and conspicuous chitinous hooks, by means of which it burrows in the fruit. The larval period varies from 15 to 18 days; pupation takes place in the soil at a depth of from a quarter of an inch to two inches. The chief injury appears to be done early in November before the heavy rains begin, as the flies are extremely active during dry, sunny weather. Cold, wet weather has a detrimental effect upon them and retards oviposition. The adult stage lasts from 1 to 9 months, according to experiments made in the insectary. No parasites emerged from puparia in the insectary. Remedial measures must be applied before melons, cucumbers, etc., are attacked. Oviposition usually begins when the fruit is about a quarter grown, but in order to ensure success, baiting should be undertaken immediately after its formation. In the experiments, fully 95 per cent. of the crop was saved from destruction on rows treated before the deposition of eggs, whereas all the fruit on the untreated rows was destroyed. *D. vertebratus* is extremely fond of sweet material and a sweetened poison-bait was placed upon the foliage and fruit of cucurbits. The following formulae were used :—(1) Arsenate of lead paste, 3 oz.; unrefined treacle or molasses, 2 lb.; water, 4 gals.; (2) Arsenate of lead paste, 3 oz.; unrefined treacle or molasses, 2 lb.; glycerine, 3 oz.; water, 4 gals.; (3) Arsenate of lead paste, 3 oz.; coarse sugar, 2½ lb.; water, 4 gals. The rainfall during November, December and January being exceptionally heavy, a great deal of inconvenience was caused by the necessity for frequent renewal of the bait. Experiments repeatedly demonstrated the fact that a slight shower of rain (from 0·06 to 0·13 inch) completely washed away no. 3 mixture, whereas nos. 1 and 2 proved more adhesive. If nos. 1 and 2 mixtures are used during dry weather, they would have to be renewed every twelve or fourteen days, and during wet weather, after about a fifth of an inch of rain has fallen. An ordinary garden syringe may be used for applying the bait. When fruits become infested, they should be removed and buried in the soil at least two feet deep.

THEOBALD (F. V.). **Aphididae found on the Apple in Britain and the Description of a New Species from Africa.**—*Canadian Entomologist, London, Ont.*, xlviii, nos. 5–8. May–June–July–August 1916, pp. 169–177, 202–214, 233–242, 261–263, 6 figs.

This paper gives a detailed account of eight species of Aphids infesting the apple in Britain with a key to them. The food-plants,

habitat and synonymy are discussed under each species. *Eriosoma lanigerum* (woolly aphis) is not dealt with. The chief object of the paper is to show that the most harmful of all apple aphids in Great Britain is Koch's *Aphis pyri*, renamed by Schouteden *Aphis kochi*, and not, as has been stated, *Aphis sorbi*, Kalt,, which was described from specimens found on *Sorbus aucuparia* and is a totally distinct species. The so-called brown, blue and rosy aphis or leaf-curling aphis of the apple in England should therefore be known as *A. kochi*.

Aphis pomi, De G., ranges throughout Britain and Europe generally, America, South Africa and Tasmania. It often occurs in considerable numbers in Britain, but never in such vast numbers as *A. kochi*, nor is it so injurious. It mainly lives on the top shoots and beneath the leaves. The whole life-cycle seems to be passed on the apple and pear, unlike *A. kochi* and *A. avenae*. It can easily be dealt with by spraying whereas *A. kochi* cannot.

Aphis kochi Sch., the brown, blue, rosy or leaf-curling aphis of apple, occurs all over Britain and in most parts of Europe, North America, Africa and apparently in Australia. All varieties of apples and pears serve as food-plants, mostly the former in Britain; the medlar is also attacked. Walker records it from *Crataegus oxyacantha*, *Sorbus aucuparia* and *Sorbus domesticus*, and Passerini on *Sorbus torminalis*, but these records are thought all to refer to the true *Aphis sorbi*. In Britain this species hatches in the latter half of April. It at first lives on the tops of the bursting buds and then enters them; as the buds open, it continues to live on the young leaves. and as these individuals mature, the leaf may curl up and partly enclose them. They soon produce living young, often with great rapidity, and the presence of these, as they grow, further accentuates the curling of the leaves. This aphis also feeds on the shoots, giving rise to contorted and stunted growth. The first winged forms found by the author occurred on 13th June 1899, and they were found onwards until 29th July, in 1914. Although they become winged in masses, a few winged individuals always occur some time before the main swarm, and others later. The winged females are very sluggish, and, like those of *A. rumicis*, collect together in masses, usually choosing the underside of a fairly large branch of the tree near its junction with the trunk. Many of these groups were noticed in 1915 to die off and remain attached to the branches. This winged summer generation migrates in July, its destination being unknown. In the beginning of September a few return migrants may appear, but the majority do not do so until October. These produce the sexual generation of apterous oviparous females and alate males. The sexuparae may occur on into mid-November, and oviparous females have been found as late as the first week in December. The females and males occur under the leaves, and when fertilised, the females crawl to the shoots and lay their eggs either singly or in small groups, never in dense masses as is done by *A. pomi*. During the past six years efforts to trace *A. kochi* to other plants have been in vain. No Aphid varies so much in colour in the apterous stage. In one district they may all be slaty-grey, in another all bluish black, in others most are plum colour or brown, but all have a small sprinkling of pale reddish or pink forms with them; occasionally colonies occur entirely of this colour. Towards the end of June a few Coccinellids, many Syrphids and a few Chrysopid larvae

may be found feeding on this Aphid. By the first week in July they become abundant, and by the second these natural enemies control the pest, but by this time all the damage has been done. Very few individuals seem to be attacked by Chalcid parasites, though the author has bred one species on two occasions. The chief enemies are the Coccinellids, *Adalia bipunctata* and *Coccinella septem-punctata*. The chief Syrphid enemies are *Syrphus ribesii* and *Lasiophthicus* (*Catabomba*) *pyrastri*, though several other larvae have been found feeding on them, including those of *Syrphus grossulariae*. Spraying has little or no effect on *A. kochi* when once the leaves are curled. Nicotine soft-soap wash is the only one that yields any appreciable result, but it is not nearly effective enough to clean the trees, as so many individuals escape owing to the dense leaf curling. Early spraying with nicotine and soap has, however, checked the damage in many cases. The best results seem to be obtained with late lime spraying, just before the blossoms open. In small plantations and gardens, stripping the curled leaves on bush trees has had excellent results, as also has autumnal spraying to kill the sexual forms.

Aphis crataegi, Kalt. (*nec* Buckton), occurs in Britain on *Pyrus malus*, *P. communis*, *Crataegus oxyacantha*, etc. Schouteden treats this species as a synonym of *A. pyri*, Fonsc., but this appears to be incorrect.

Aphis (*Myzus*) *nigra* is a new name proposed for *A. oxyacanthae*, Koch (*nec* Schrank) and *M. oxyacanthae*, Schouteden. This species has been found in Britain on apple and hawthorn.

Aphis rumicis, L., is abundant in Britain on many plants, especially *Rumex* spp. (docks), *Fabia* spp. (beans), *Papaver* spp. (poppies) and *Euonymus* spp.

Siphocoryne avenae, F., is found in Europe generally, America and perhaps Africa.

Phorodon humuli, Schrank (hop and prune aphis) was found once on apple. It was not only living on the apple foliage, but was reproducing and developed large colonies at Wye in August and September 1911, which gave rise to an alate brood that migrated during the latter month.

A new species is described from Africa, viz. :—*Aphis pomonella*, found at Nairobi, British East Africa, on the apple. Four other Aphids recorded on apple in America are :—*Myzus persicae*, Sulzer, *Aphis brevis*, Sand., *A. bakeri*, Cow., and *A. medicaginis*, Koch.

FRENCH (J. N.). **Wireworm Control.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 6, June 1916, pp. 225–235, 3 figs.

Wireworm injury to beet and bean crops in the Oxnard district of California is chiefly due to *Limonius californicus*, In consequence of later planting, beans are usually more seriously damaged and are stunted in growth, with a corresponding decrease in yield. The extent of injury varies very considerably in different years ; it may be restricted to a definite area for several successive years, may move from one side of a field to another, or may be of slight or marked intensity in alternate years. In the last instance, a species of wireworm with a shorter life-cycle may be present. The date at which

activity is resumed in spring is dependent on soil temperature and to some extent on humidity. The larvae are sensitive to heat, being killed in from 5 to 10 minutes by exposure to sunshine or by contact with warm water.

Various control measures against larval, pupal, and adult stages were tested during 1914 and 1915. The use of poisoned baits against the larvae gave entirely negative results. Sodium cyanide at the rate of from ½ oz. to 5 ozs. to 10 cubic feet killed from 92 to 99 per cent. of the larvae. It was found necessary to place the cyanide at a depth of 8 inches and at a distance of 4 inches from the plant, and to roll the surface of the soil after treatment. From three to seven days were required to effect the destruction of wireworms. Field experiments conducted late in the season on light sandy soil showed that from 35 to 80 per cent. of the larvae were destroyed. The germination of bean seeds was not affected if sowing took place two weeks after treatment. The best trap for the larvae was potatoes of good quality; pieces were placed in rows 5 feet apart and from 6 to 10 feet apart in the row, and renewed about five times during the season. About 4,000 wireworms were captured from one acre by this method. The use of potato is preferable to that of sodium cyanide owing to its cheapness. Autumn ploughing against the pupae, when carried out early, would probably be of value, but has practically no effect after the beginning of November.

The period of secondary hibernation which the adults undergo in early spring was also made the subject of experiment. Small piles of bean straw placed 150 feet apart on 8th March, when examined a week later, showed from 23 to 80 beetles. One pile allowed to remain for a total of 17 days, contained 165 adults. Very few were present in wet straw, thus indicating the necessity for turning over the latter in rainy weather. A combination of the straw and potato-trap methods is recommended as worthy of trial.

MASKEW (F.). **Quarantine Division; Report for the Month of April 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 6, June 1916, pp. 236–237.

The following pests were intercepted during the month of April:—From China: weevil larvae in sweet potatoes. From Florida: *Eudiagogus pulcher* in celery; *Phomopsis citri* and *Lepidosaphes* sp. on grapefruit. From Hawaii: weevil larvae in seed pods; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapple; *Coccus longulus* and *Aphis* sp. on betel leaves; *Howardia biclavis, Lepidosaphes beckii* and *Pseudaonidia trilobitiformis* on *Hibiscus* cuttings; Trypetid larvae in string beans, cucumbers and squash. From Japan: *Phomopsis citri* and a Coccid on Japanese oranges; *Diaporthe parasitica* on chestnut; *Pseudaonidia duplex* on camellias; an egg-cluster of *Lymantria (Porthetria) dispar* on wistaria. From Missouri: *Coccus hesperidum, Ceroplastes* sp., *Pseudococcus* sp., and *Pseudischnaspis bowreyi* on *Agave* sp. From Tahiti: *Morganella maskelli* and *Lepidosaphes beckii* on oranges; weevil larvae in sweet potatoes and Lepidopterous larvae in seeds. From Arizona: Lepidopterous larvae and *Chloridea obsoleta* on tomatoes. From Central America: *Aspidiotus cyanophylli* and *Pseudococcus* sp. on banana. From Louisiana:

Lepidosaphes beckii and *Phomopsis citri* on grapefruit. From Manila: *Pseudococcus* sp. and *Diaspis boisduvalii* on orchids. From Mexico: *Chloridea obsoleta* on tomatoes and *Fiorinia fioriniae* on coconuts. From New Jersey: *Lepidosaphes ulmi* on cottonwood cuttings; *Diaspis boisduvalii, Aspidiotus cyanophylli, Pulvinaria* sp., *Coccus longulus* and *Chrysomphalus dictyospermi* on orchids. From Pennsylvania: *Cerataphis lataniae* on *Cocos weddelliana*; *Coccus hesperidum* on *Anthurium scherzerianum*; *Pseudococcus adonidum* (*longispinus*) on dracaena palm, and an unidentified Coccid on *Anthurium* sp.

EHRHORN (E. M.). **Report of the Division of Entomology.**—*Hawaiian Forester and Agriculturist, Honolulu*, xiii, no. 5, May 1916, pp. 148-151. [Received 22nd July 1916.]

Insect pests intercepted during February 1916 included:—From Panama: *Aspidiotus cyanophylli* on orchids and *Aulacaspis* (*Diaspis*) *pentagona* on *Hibiscus* cuttings. From Italy: *Bruchus pisorum* in beans.

The following parasites of fruit-flies were bred and liberated:—*Tetrastichus giffardi, Diachasma fullawayi, D. tryoni.* Parasites of horn, house, and stable flies liberated were *Galesus silvestrii, Dirhinus giffardi*, African and Philippine *Spalangia* and African horn-fly parasite. *Paraleptomastix abnormis*, a parasite of the mealy bug obtained from California was reared and liberated in infested citrus plantations.

JARVIS (E.). **Destruction of Sugar-Cane Pests.**—*Queensland Agric. Jl., Brisbane*, v, no. 6, June 1916, pp. 330-331.

A new Lepidopterous pest of sugar-cane found at Gordonvale has been identified as *Mocis frugalis*, F. This species, which is common in Australia, feeds in the larval stage on the leaves of young and old canes. Pupation takes place within a rolled leaf. At Gordonvale the larvae were most abundant in plantations in which weeds were present. Adults were reared from 90 per cent. of the pupae collected; the remainder were parasitised by a Tachinid fly. The numbers of the ant, *Pheidole megacephala*, a beneficial insect in cane-fields, were very much reduced owing to the dry weather.

FROGGATT (W. W.). **A Descriptive Catalogue of the Scale Insects ("Coccidae") of Australia.**—*Agric. Gaz. N.S.W., Sydney*, xxvii, no. 6, June 1916, pp. 425-430, 2 plates.

The following species are described:—*Eriococcus agonis*, Fuller, on *Agonis flexuosa* (native peppermint); *E. apiomorphae*, Fuller, from galls of *Apiomorpha maliformis* on eucalyptus; *E. angulatus*, sp. n., on *Araucaria excelsa*; *E. araucariae*, Mask., on *A. excelsa*; *E. bursariae*, sp. n., on *Bursaria spinosa* (blackthorn); *E. buxi*, Fonsc., on *Trachymone billardieri*; *E. confusus*, Mask., on *Eucalyptus viminalis*; *E. coriaceus*, Mask., on *Eucalyptus globulus* and other species; and *E. crofti*, sp. n., on *Eucalyptus piperita*.

Bag-Shelter Moths attacking Wattles.—*Agric. Gaz. N.S.W., Sydney*, xxvii, no. 6, June 1916, p. 440.

The Notodontid, *Teara contraria*, has recently caused serious damage to wattles in the Scone district of New South Wales. This insect occurs throughout the central and western portions of Australia, attacking various species of wattles. Control measures include the destruction of the nests, spraying with lead arsenate at the rate of 2 lb. to 50 gals. water, and breaking up the soil below affected plants to expose the pupae.

HARRISON (J. B.), BANCROFT (C. K.) & BODKIN (G. E.). **The Cultivation of Limes. iii.**—*Jl. Bd. Agric. British Guiana, Georgetown*, ix, no. 3, May 1916, pp. 122–129. [Received 25th July 1916.]

The most important insect pests of limes in British Guiana are scale-insects, including *Lepidosaphes beckii*, Newm. (*Mytilaspis citricola*, Pack.), and *Chionaspis citri*, Comst. These are best controlled by spraying with resin wash, prepared according to the formula, 8 lb. resin, 6 lb. washing soda, 4 gals. water; the stock solution is diluted four or six times before use. *Pseudococcus citri*, Risso, on leaves and fruit, can be destroyed by spraying with kerosene emulsion, prepared by diluting to six times its volume a stock solution consisting of 2 gals. kerosene, ½ lb. soap and 1 gal. water. The ant, *Atta cephalotes*, L., may be troublesome in newly-planted areas. The nests may be destroyed by "puddling," if the soil is not too sandy, by fumigation with carbon bisulphide or sulphur fumes, or by the construction of a trench filled with water round the nest. The caterpillars of *Papilio anchisiades*, Esp., may attack the foliage. They feed only at night, and during the day congregate near the base of the tree, thus rendering their collection an easy matter.

BOFILL y PICHOT (J. M.). **Noticias anatómico biológicas del *Oligomerus brunneus*, Oliv., y de su parásito el *Pediculoides ventricosus*, Newp.** [Anatomical and biological notes on *Oligomerus brunneus*, Oliv., and its parasite *Pediculoides ventricosus*, Newp.]—*Memorias R. Acad. Cienc. y Artes, Barcelona*, xii, no. 12, March 1916, pp. 201–218, 2 plates.

Living trees are not attacked by the Anobiid, *Oligomerus brunneus*, Ol., which has been found infesting the wood of beech, oak, walnut and other fruit trees and also infests furniture. Attacked timber shows holes of 2–3 mm. in diameter through which frass and excreta are ejected and the adult insect escapes. The galleries measure from 0·2 to 5·0 mm. in diameter and contain chambers at intervals. Pupation takes place within these and the adults are also often found in them. It is difficult to indicate the length of the larval period. The adults appear from early April to late September. The pupal stage lasts from eight to nine days. In an unsuccessful search for the eggs of this Anobiid a number of female specimens of *Pediculoides ventricosus*, Newp., were discovered. This Acarid was repeatedly found in fine frass from furniture, but never in frass in timber out of doors. Experimentally, however, when *P. ventricosus* was placed in bores in outdoor timber the beetle larvae were soon attacked and killed

by the female Acarids. It was further ascertained that larvae of various insects were also attacked, if soft-skinned. *O. brunneus* has one generation a year, while from June to October alone *P. ventricosus* was observed to produce six, so that the destruction of the former would be assured were it not able to found colonies at a distance from its enemy, which does not possess the same migratory powers. A description of both species is given.

Carrasquilla H (T.). **Enfermedades y Enemigos del Cacao.** [Diseases and Pests of Cacao.]—*Rev. Agricola, Bogotá*, ii, nos. 1–2, January-Febrero 1916, pp. 6–24, 90–103. [Received 7th July 1916.]

This paper deals in a popular form with the local diseases and pests of cacao, no scientific names being given.

Lotrionte (G.). **Consigli pratici sui mezzi per combattere la fumaggine degli olivi e di altri alberi.** [Practical advice on the means for combating sooty fungus of the olive and other trees.] —*Cattedra Ambulante d'Agricultura, Rome*, 1916, 11 pp.

On the olive the presence of the sooty fungus is closely related to that of Coccids, such as *Saissetia* (*Lecanium*) *oleae*, *Philippia oleae*, etc., while *Coccus hesperidum* and *Icerya purchasi* are found with it on citrus and other plants. The Lotrionte formula for a combined insecticide and fungicide is: Soft soap, 4–6 lb.; finest powdered sulphur (as used for vines), 10 lb.; commercial creolin, 2–3 lb.; water, to make up to 20 gals. This gives the best results. It is prepared by dissolving the soap in about 4–6 gals. of water and then adding the sulphur, little by little, to the soap solution. When about to spray, the creolin is added and the remainder of the water is mixed in. It is very important to stir the spray liquid before and during spraying, which should be done in fine weather.

Destruction de la pyrale. [The destruction of the Vine Pyralis.]—*La Vie Agric., Paris*, vi, no. 30, 22nd July 1916, p. 66.

A simple method of destroying *Sparganothis pilleriana* consists of sprinkling the vines with sifted wood ashes. The ash contains potash, and either kills the insect or causes it to migrate. The application should be made at the flowering period. There is no risk of scorching.

Dudgeon (G. C.). **The Boll Worm in Egypt.**—Reprint from *Trans. 3rd International Congress. Trop. Agric., London*, 1916, pp. 1–34, 2 plates. [Received 26th July 1916.]

The plants attacked by *Earias insulana*, Boisd., in Egypt are cotton and *Hibiscus* spp. Eggs are deposited on the former on the bolls, terminal buds, and perhaps on the squares, also on flower buds, petioles, leaves, or in the leaf axils; on the latter they are placed on the flower buds, fruit or in the leaf axils. The duration of the egg-laying period and the number of eggs deposited varies with the season. In September a female kept in captivity deposited 233 eggs in five days; another in December laid 99 in 19 days. The duration of the adult stage in the female is more than a month. The incubation period

of the egg varies from three to four days in summer and from 10 to 12 days in winter. Injury to cotton by the early generations of larvae is of necessity confined to the terminal shoots, but these are deserted for the flower buds and bolls when they appear. The duration of the larval period in summer is about two weeks. Pupation takes place in folds of the involucre or between the side of the capsule and the involucre; occasionally the cocoons are found attached to the stem or leaves. The length of this stage varies in summer from 10 to 14 days and in winter from 35 to 52 days. It is estimated that only 10 per cent. of the eggs of the first generation reach maturity, while of the succeeding broods about 50 per cent. give rise to adults.

Insect enemies of *E. insulana* include a Lepidopterous larva, perhaps *Cryptoblabes gnidiella*, Mill., the Braconid, *Rhogas kitcheneri*, Dudgeon, and an Ichneumon, possibly *Pimpla roborator*, Nees. The last-named species is also known to attack *Gelechia gossypiella*, Saund. (pink boll worm).

The findings of the Cotton-worm and Boll-worm Commission of 1912 indicate that the most efficient control measures are those which have as their object the destruction of larvae and pupae on waste cotton wood, etc., before January. Regulations for the uprooting or deep cutting of plants of cotton and *Hibiscus* spp. before 15th December of each year have had a marked effect in decreasing the numbers of *E. insulana.*

GOUGH (L. H.). **Note on *Rhogas kitcheneri*, Dudgeon and Gough.**—Reprint from *Trans. 3rd International Congress Trop. Agric., London*, 1916, pp. 35–36. [Received 26th July 1916.]

Rhogas kitcheneri is a parasite of the larvae of *Earias insulana* and *Ephestia cautella* in Egypt. The number of larvae in one host varies from 1 to 11. The death of the host occurs one or two weeks before the emergence of the parasite for pupation. During the winter the duration of the pupal stage is four or five weeks. The length of the adult stage exceeds 37 days.

COCKAYNE (A. H.) & WATERS (R.). **The Chaff-mite: Methods of control.**—*Jl. Agriculture, Wellington, N.Z.*, xii, no. 5, 20th May 1916, pp. 372–379, 2 figs.

During August 1915 a very severe attack of *Tyroglyphus longior* occurred in fodder stored at Wellington, the pest being present in enormous numbers. Chaff and bran were mainly attacked; hay and oats did not appear to be damaged to the same extent, owing to their offering the mites less facilities for securing food. As very little was known with regard to the control of mites, a series of experiments was carried out.

Investigations regarding the penetrative power of heat through infested material showed the difficulty of raising a sack of chaff to a sufficient temperature by covering it with tarpaulins and then introducing into it a continuous and large supply of hot, dry air. The mites, however, showed very little resistance to heat, and individuals subjected to a temperature of 140° F. all died in five minutes. Mites exposed for one hour to the direct rays of the sun (80° F.) all died, but the effect of light may be important in this case. As the mites succumb at

such comparatively low temperatures, the application of heat in combination with sifting and blowing may prove of some value. In experiments on the effect of cold, a mite-infested sack of chaff was placed in a chamber at 27° F. at noon; 24 hours later, the temperature at the centre of the sack had been lowered to 40° F., the mites being unaffected. The sack was then taken into a chamber at zero and in 20 hours the mites were all dead, the temperature in the centre of the sack being 17° F. Mites exposed to the rays of a 250 candle-power arc lamp died within two hours. Only negative results were obtained in experiments with pressure, in which half a dozen sacks of chaff were subjected to pressure rising gradually to 35 tons. Hydrocyanic acid gas proved unsatisfactory as regards penetrative power, mites being found alive in three sacks of chaff fumigated with the heavy dose of 6 oz. cyanide of potassium in 100 cubic feet of space. The same three sacks were subsequently exposed to the fumes of two sulphur candles for twelve hours in the same airtight chamber. The mites were still living at the end of this time and this result was also due to lack of penetrative power, as death ensued when the mites were exposed directly to these fumes for one hour. Laboratory experiments showed that carbon dioxide was also effective when applied directly to the mites. Carbon bisulphide was found to have better penetrative power; three sacks in which 6 oz., 12 oz., and 18 oz. respectively, were placed, were sewn up and wrapped in a tarpaulin. After twenty-four hours, some of the liquid was still unvolatilised and many living mites were found in each sack. Seventeen hours later all the liquid had volatilised, and tests made at various parts of each sack yielded only a few living mites. It was noted that the mites were often particularly abundant in the material of the sacks, and this probably accounts for the fact that an improvement in the condition of infested chaff may be seen when it has been transferred from one place to another, the mites being shaken off the outside of the sacks. Trials with hand sieves showed that the mites, as well as any dust present, separated readily. No mites were found in infested chaff after it had been well shaken in a sieve with round holes of 1 mm. in diameter; 227 grammes of infested chaff yielded 1·52 grammes of dust and mites.

The comparatively satisfactory results yielded by carbon bisulphide caused this method to be employed on about 16,000 sacks. Bran was satisfactorily treated in the same way.

LOUNSBURY (C. P.). **Plant-killing Insects: The Indian Cochineal.**—Reprint from *Agric. Jl. S. Africa, Pretoria,* June 1915, 7 pp. [Received 19th July 1916.]

This paper describes the use of the cochineal insect [*Dactylopius coccus*] in controlling *Opuntia monocantha* (prickly pear) in South Africa [see this *Review*, Ser. A, ii, p. 440].

CAESAR (L.). **Insects attacking grapes.**—*Ontario Dept. Agric., Toronto,* Fruit Branch Bull. no. 237 (The Grape in Ontario), March 1916, pp. 39–44, 4 figs. [Received 19th July 1916.]

The chief grape pests in Ontario are *Typhlocyba comes* (grape leafhopper), *Haltica chalybea* (grape-vine flea-beetle), and *Macrodactylus subspinosus* (rose-chafer). Minor pests are *Polychrosis viteana* (grape-berry moth), *Fidia viticida* (grape root-worm) and *Oxyptilus perisceli-*

dactylus (grape plume moth). *T. comes* is the most common insect attacking grapes in Ontario. It is usually most numerous in the neighbourhood of woods and waste places, which provide good winter quarters for the adults, but also occurs in vineyards with comparatively clean surroundings. The adults appear in the warm days of spring and feed on almost any green plant, being specially fond of raspberries and strawberries, and migrate to vineyards as soon as the foliage of the grape is sufficiently developed. Eggs are laid in the tissues of the leaf during June and the nymphs from these begin to hatch towards the end of June. There is a partial second brood, the winter being passed in the adult stage only. In the majority of cases clean culture will control this pest, but where necessary, the underside of the leaves should be thoroughly sprayed with Black-Leaf 40, one part to 1,500-1,600 parts of water or of Bordeaux mixture. In most years the best time for application is from the 10th to the 20th of July.

Haltica chalybea does a considerable amount of damage almost every year in some localities. Vineyards may be attacked in spring by the over-wintering adults, in late June and July by the larvae, or in late July, August and September by the new brood of beetles, the first attack being the only one which causes appreciable damage, as the beetles then attack the swelling buds. Control includes clean culture, the collection of the adults in frames saturated with kerosene, and spraying. The frames measure 6 feet long by 3 feet wide, and are covered over with muslin saturated with kerosene, which kills the beetles when they drop. Against the spring attack, a spray containing 5 lb. lead arsenate in 40 gals. water is advised. The addition of ½ gal. of cheap molasses is said to assist in attracting the beetles. If rain occurs soon after spraying, it must be repeated. To prevent injury in the following year spraying should also be carried out against the larvae, with three pounds of lead arsenate in 40 gals. of water or preferably Bordeaux mixture, as this will help to control fungus diseases. One application to the foliage about the end of June, or as soon as the larvae are present, should be sufficient.

Macrodactylus subspinosus fortunately breeds only in light or gravelly soil, especially in localities where there is much waste land of this character. In such places whole vineyards may be very severely damaged. The beetles appear in swarms and feed upon the blossoms and young berries, and to some extent on the leaves, for about two weeks; they then migrate to other plants, such as the sumac, raspberry, blackberry and rose. They often attack the foliage and young fruit of apples, pears, plums and cherries, and do considerable harm. In about a month from the time they first appear, most of the adults have died, the females having deposited their eggs in light sandy or gravelly soil. The larvae feed on the roots of weeds and grasses and become nearly full-grown by November. They then burrow down to a depth of about a foot and remain there over the winter, pupating about the 24th May from 3 to 6 inches below the surface. One of the means of control consists of ploughing the breeding places some 6 or 7 inches deep soon after 24th May, while disking and harrowing them several times before 21st June will destroy great numbers of pupae. A spray containing 5 lb. lead arsenate and 1 gal. cheap molasses to 40 gals. of water should be carefully applied just as the beetles attack the grapes. In case of rain the application should be repeated.

ZAVITZ (C. A.). **Treatments for the Colorado Potato Beetle, *Doryphora decemlineata*.**—*Ontario Dept. Agric., Toronto,* Ont. Agric. Coll. Bull. no. 239 (Potatoes), May 1916, pp. 75–78.

In experiments against *Leptinotarsa* (*Doryphora*) *decemlineata*, twenty-one separate examinations were made of the number of beetles per plant a few days after the first treatment in the season, as well as of the percentage of foliage eaten a few days after the second and third treatments. Eleven plots, each differently treated, were examined on each occasion, the results of these examinations being given in a table. The first figure represents the average number of beetles per plant and the second figure the average percentage of foliage eaten. Four preparations of Paris green and water (4 plots) gave 3·3 and 5·0; three preparations of commercial lead arsenate (3 plots) gave 4·0 and 8·1; three preparations of home-made lead arsenate (3 plots) gave 10·7 and 33·1; hand-picking (1 plot) gave 2·8 and 14·9.

CHILDS (L.) **Entomological Investigations, 1915: The Fruit-tree Leaf-roller; Codling Moth Investigations; Woolly Aphis Investigations for 1916; Strawberry-root Weevil Investigations for 1916.**—*Rept. Hood River Branch Expt. Sta.* for 1914–1915, *Oregon Agric. Coll., Corvallis,* pp. 47–61, 2 figs.

The data relating to the control of the fruit-tree leaf-roller [*Cacoecia argyrospila*] in this paper have already been abstracted [see this *Review*, Ser. A, iii, p. 758].

Against *Cydia pomonella*, the calyx and 30-day spray (the first two applications) are advised in both cases for the control of the first brood of caterpillars. Where a loss of not more than 8 per cent. was experienced in 1915, one well-timed summer spray, early in August, would be effective against the second generation. Where the infestation was over 8 per cent. or 10 per cent., two summer applications should be made, the first of these being made about 20th July and the other towards the middle or end of August.

Preliminary investigations on the woolly aphis [*Eriosoma lanigerum*], which has increased in the Hood River district in the last two years, showed that the Aphids pass the winter, for the most part, as nymphs or young insects. The following contact insecticide is recommended against them: miscible oil, 4 to 5 U.S. gals.; whale-oil soap, 2 to 3 lb.; water, 100 gals. If *C. argyrospila* is present, the oil should be increased to 6 U.S. gals.

Preventive measures against the strawberry-root weevil [*Otiorrhynchus ovatus*] include the selection of plants from non-infested districts and the destruction of the soil and packing around them. These precautions will lessen the chance of infesting new areas. At present there is no really satisfactory means of controlling this pest.

QUAINTANCE (A. L.). **The Leaf Blister Mite of Pear and Apple.**—*U.S. Dept. Agric., Washington, D.C.,* Farmers' Bull. no. 722, 21st April 1916, 6 pp., 4 figs.

This paper deals briefly with the origin, distribution, habits, and control of *Eriophyes pyri*, Pagst. (leaf blister mite of pear and apple). Though the chief food-plants are pear and apple, this mite has also

been found on *Sorbus aria* (white beam), *S. aucuparia* (European mountain ash), *S. torminalis* (wild service tree), *Amelanchier vulgaris* (service berry), and *Cotoneaster vulgaris.* The chief natural enemy is another mite, *Seius pomi*, Parr.'

QUAINTANCE (A. L.). **The Oyster-shell Scale and the Scurfy Scale.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 723, 26th April 1916, 14 pp., 3 figs. [Received 21st July 1916.]

This bulletin deals with the bionomics and control of *Lepidosaphes ulmi*, L. (oyster-shell scale) and *Chionaspis furfura*, Fitch (scurfy scale) which, with the exception of *Aspidiotus perniciosus*, Comst. (San José scale), are more frequently the subject of enquiry by American fruit-growers than all other species of scale-insects combined. Lists of 119 food-plants of *L. ulmi* and 37 of *C. furfura* are given. Formulae for preparing kerosene emulsion, fish-oil soap wash, lime-sulphur and lime-sulphur concentrates are appended.

Regulations Governing the Export Shipment from the Philippine Islands of all Plants and the Materials used in the Packing thereof.—*Philippine Agric. Rev., Manila*, ix, no. 2, 1916, pp. 57-59. [Received 25th July 1916.]

These regulations amend those of a previous order of the Bureau of Agriculture. The terms provide for the inspection and necessary treatment of nursery stock, trees, shrubs, seeds, etc., but not of fruit or vegetables intended for food, before shipment from the Islands.

SCHULTZE (W.). **A Catalogue of Philippine Coleoptera.**—*Philippine Jl. Sci., Manila*, xi, Sec. D, nos. 1 and 2, January and March 1916, pp. 1-194. [Received 25th July 1916.]

In addition to containing a record of species of Coleoptera occurring in the Philippine Islands, a list is given of 119 species of economic importance, with the food-plant in each case.

DE LONG (D. M.). **The Leafhoppers or Jassoidea of Tennessee.**—*Tennessee State Bd. Entom., Knoxville*, Bull. no. 17, June 1916, 112 pp., 4 figs, 2 plates.

An account is given of representatives of the families, JASSIDAE, TETTIGONIELLIDAE, BYTHOSCOPIDAE and TYPHLOCYBIDAE occurring in Tennessee. The species of economic importance include:—*Empoasca mali* and *E. flavescens* on apple; *Typhlocyba comes* and *T. obliqua* on grapevines; *Homalodisca triquetra, Aulacizes irrorata, Oncometopia undata* and *O. lateralis* on cotton; *Draeculacephala reticulata, D. mollipes, Deltocephalus* spp., *Athysanus exitiosus, Agallia constricta* and *A. sanguinolenta* on cereals and grasses.

GIRAULT (A. A.). **Descriptions of and Observations on some Chalcidoid Hymenoptera.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 7, July 1916, pp. 242-246.

The following species, chiefly from North America, are described:—*Eupelmus marylandicus*, sp. n.; *E. speciosus*, sp. n.; *E. cyaniceps*, Ashm., var. *utahensis*, var. n.; *E. cyaniceps*, Ashm., var. *amicus*,

var. n.; *E. charitopoides*, sp. n.; *Scutellista cyanea*, Motsch., and *Euryloma galeati*, sp. n., reared from *Ceroplastes galeatus*, Newst., in Uganda; *Aphelinus automatus*, Girault, from *Aphis setariae*, Turner; *Coelopisthia confusa*, sp. n.

In a separate paper the Pteromalid, *Tomocerodes americana*, gen. et sp. n., is described from Mexico.

WEISS (H. B.). **A Japanese Bug new to New Jersey (Hemip.)**—*Canadian Entomologist, London, Ont.*, xlviii, no. 7, July 1916, p. 255.

The Tingitid, *Stephanitis azaleae*, Horv., was found in considerable numbers on *Azalea amaena* var. *hinodegiri* in several localities in New Jersey in the summer of 1915. Most of the infested plants had been imported from Japan.

COTTE (J.). **Nouvel** *Eriophyes* **(Acar.), Parasite des Euphorbes.** [A new *Eriophyes* parasitic on *Euphorbia*.]—*Bull. Soc. Entom. France, Paris*, no. 12, 1916, pp. 204–207, 2 figs.

A description is given of *Eriophyes hispidus*, sp. n., a mite infesting *Euphorbia spinosa*, *E. segetalis*, and *E. characias*, in the South of France.

SCHMIEDEKNECHT (O.). **Die Deutschen Gattungen und Arten der Ichneumonidentribus der Anomaloninen.** [The German genera and species of the Ichneumonid tribe ANOMALONINAE.]—*Naturwissenschftl. Zeitschr. Forst- u. Landwirtschft., Stuttgart*, xiv, nos. 3–4, March–April 1916, pp. 97–116, 4 figs. [Received 18th August 1916.]

This paper is purely systematic in character. A bibliography of 24 works is given.

STROHMENGER (—). **Ulmen-Rindenrosen verursacht durch die Ueberwinterungsgängen des** *Pteleobius vittatus*, **Fabr.** [Elm "bark-galls" caused by the hibernation galleries of *P. vittatus*, Fabr.]—*Naturwissenschftl. Zeitschr. Forst- u. Landwirtschft., Stuttgart*, xiv, nos. 3–4, March–April 1916, pp. 116–121, 1 plate. [Received 18th August 1916.]

The only known case of local injury to the bark of healthy tree trunks by the hibernation galleries of a bark beetle is that of the ash, the species responsible being *Hylesinus* (*Leperisinus*) *fraxini*, Panz. Forest entomologists appear to have overlooked the fact that the smaller related species, *Pteleobius vittatus*, F., also bores hibernation galleries (i.e. galleries in which breeding does not take place) in the bark of healthy elms and that this injury causes similar, though smaller, galls. The excrescence is caused by the beetle injury, followed by the expansion due to the growth of the trunk. The galleries are exceedingly short both in the case of *P. vittatus* and *H. fraxini*, and lead to the supposition that the beetle feeds on the oozing sap and perhaps also on fungi growing on the sap and not on the bore material or frass.

WILDERMUTH (V. L.). **California Green Lacewing Fly.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 14, 3rd July 1916, pp. 515-525, 7 figs., 5 tables.

Chrysopa californica, Coq. (green lacewing fly) occurs in Texas, Arizona, New Mexico, Nevada, Lower California, and probably in Utah. The larvae are predaceous on various insects, including :—*Bryobia pratensis*, Garm. (clover mite), *Tetranychus mytilaspidis*, Riley (two-spotted mite), *T. telarius*, L. (red spider), *Empoasca mali*, Le B. (apple leaf-hopper), *Typhlocyba comes*, Say (grape leaf-hopper), *Psylla pyricola*, Foerst. (pear psylla), *Hyalopterus arundinis*, F. (mealy plum aphis), *Aphis gossypii*, Glov. (melon aphis), *A. persicae-niger*, Smith (black peach aphis), *Macrosiphum citrifolii*, Ashm. (citrus aphis), *Pseudococcus citri*, Risso (mealy bug), *Eulecanium pruinosum*, Coq. (frosted scale), *Chrysomphalus aurantii*, Mask. (red scale), *Lepidosaphes beckii*, Newm. (purple scale), *Euthrips tritici*, Fitch (wheat thrips), *Notophallus viridis*, Banks (barley mite) and *Toxoptera graminum*, Rond. (wheat aphis). Adults appear in southern Arizona from February to May, and again in October and November. Pairing takes place soon after emergence; egg-laying begins on the following day and may continue for three or four days. No feeding has been observed in the adult stage. The incubation period of the egg varies from 6 to 12 days, the average being eight. The duration of the larval stage varies from 11 to 22 days, with an average of 16 days, and the number of full-grown Aphids eaten during this period is from 74 to 160, under laboratory conditions. In the field, a larva probably consumes from 300 to 400 young and full-grown Aphids in the course of its development. Pupation takes place in a cocoon attached to a leaf; the cocoons occur singly or in groups. The duration of this stage averages 16 days in March and 20 days in November. In the Salt River Valley of Arizona, the period between the end of October and the middle of February is passed in the pupal or adult stage. In the same latitude there are at least six generations annually. Natural enemies of *C. californica* are robber flies (Asilids), certain Rhynchota, *Contopus richardsonii* (wood pewee) and *Chordeiles virginianus* (night-hawk). Several parasites occur in California, but these have not been observed in Arizona.

RÖRIG (G.). **Achtet auf die Kartoffelkäfer!** [Warning against the potato-beetle.]—*Deutsche Landwirtschftl. Presse, Berlin*, xliii, no. 44, 31st May 1916, p. 376, 1 fig.

The German Ministry of Agriculture has issued a circular, dated 5th April 1916, drawing the attention of the authorities to the necessity for carefully watching the potato-fields in order that the appearance of *Leptinotarsa* (*Chrysomela*) *decemlineata* (Colorado potato beetle) may be instantly noted and immediate measures taken. An infestation of the potato fields would be doubly unfortunate in view of the increasing importance of potatoes as a national food.

(C311) Wt.P1/106. 1,500. 10.16. B.& F.Ltd. Gp.11/3.

BAHR (L.). **Die Krankheiten der Honigbiene und ihrer Brut.** [The diseases of the honeybee and of its brood.]—*Deutsche Tierärztl. Wochenschr., Hannover*, xxiv, nos. 28 & 29, 8th & 15th July 1916, pp. 255–258 & 264–266, 2 figs.

In this paper on bee diseases, it is stated that weak or neglected colonies are often attacked by the larvae of the moths, *Galleria mellonella* and *Achroia grisella*. A bibliography of twelve works is given.

DAWE (M. T.). **Memorándum sobre la destrucción de la langosta par la mosca langosticida colombiana.** [A note on the destruction of locusts by the Colombian locust-killing fly.]—*Rev Agricola, Bogotá*, ii, no. 3, March 1916, pp. 143-150. [Received 1st August 1916.]

Specimens of a fly parasitic on locusts have been received from two localities in Colombia, Ocana and Colegio; the Imperial Bureau of Entomology has been asked to identify the species.* These places are at an altitude of 3,824 and 3,972 feet respectively and have an average temperature of 71° F. As the locust [*Schistocerca paranensis*] which is this fly's preferred host extends up to 5,000 feet, it is probable that the parasite has a similar range.

This paper also reviews the various methods used against locusts and gives a list of the locust parasites that have been recorded in various parts of the world.

OBERSTEIN (—). **Ueber ein Massenauftreten von *Phora rufipes*, Meig., Larven bei Keimversuchen mit Woll-Luzerne.** [The occurrence of large numbers of the larvae of *Phora rufipes*, Meig., in experiments in germinating Woll-Luzerne.]—*Zeitschr. für Pflanzenkrankh., Stuttgart*, xxvi, no. 2, 1st May 1916, pp. 104–105. [Received 18th August 1916.]

In the course of germination tests with "Woll-Luzerne" a number of larvae emerged from the sand and filter paper beds used. These larvae, which were identified as those of *Phora rufipes*, Meig., attacked the swollen seed and the young seedlings. They were also found at a later date in a sample of wheat seed.

MUSSO (L.). **Campagne d'expérimentation de la méthode biologique contre les *Schistocerca peregrina*, dans la région de Bougzoul-Msiline, commune mixte de Boghari (département d'Alger) Mai-Juin 1915.** [A trial campaign of the biological method against *Schistocerca peregrina* in the region of Bougzoul-Msiline, mixed commune of Boghari (department of Algiers), in May–June 1915.]—*Ann. Inst. Pasteur, Paris*, xxx, no. 7, July 1916, pp. 319–329, 4 figs., 1 sketch-map.

This is a detailed account of the author's work in the district under his charge in the anti-locust campaign in Algeria in 1915 [see this *Review*, Ser. A, iv, pp. 45 and 351]. It confirms the fact that the

[* The specimens included examples of *Sarcophaga caridei*, Brèthes, and another species of doubtful identity.—ED.]

biological method should be the principal means of primary defence in desert or semi-desert portions of the colony, or in parts where native labour is scarce and crops are not immediately menaced. Under other conditions it should be used as an accessory to other control measures. The following were the preferred food-plants of *Schistocerca peregrina*: *Peganum harmala, Salsola vermiculata, Anabasis articulata, Noaea spinosissima, Artemisia herba-alba, Atriplex halimus* and a species of *Tamarix* growing on the banks of rivers.

BORODAIEVSKY (P.). **Наблюденія въ 1913 году надъ жизнью вредныхъ насѣкомыхъ Мохоѣдовской дачѣ Мохоѣдовскаго лѣсничества Минской губерніи.** [Observations on the life of insect-pests in the Mokhoiedov woods of the Mokhoiedov Forestry of the govt. of Minsk in 1913.]—**«Лѣсной Журналъ.»** [*Forestry Journal*], *Petrograd*, xlv, no. 8–9, 1915, pp. 1222–1247, 12 figs.

The first instalment of this paper describes a number of experiments with bark beetles. Some pine trees were felled and cut into logs on the 10th March; ten of these logs, from 9–16 inches thick and 6½–13 feet long, were sunk vertically into the soil in the wood, while seven others, 13–15 inches thick and 4–6 feet long, were put vertically on stands 12–19 inches above the ground; others were placed horizontally on trestles at heights of 4–14 inches and two, 16 and 20 feet long respectively, at a height of 3½ feet. The cut surfaces of the logs were coated with paraffin. These logs were kept under observation, and as they became infested, the mines were numbered and periodically opened.

Myelophilus minor, Hart., was on the wing in the second half of March and, owing to a spell of cold weather, again at the beginning of April. On the 31st March oviposition had already taken place and mines from 14 to 22 mm. long were found in some trees in the woods, while on the trap logs the boring was just beginning. Of these, two placed horizontally 3½ feet above the ground showed the greatest infestation, while on those at 8½ and 10½ inches, few or no beetles were found. The beetles did not settle on the logs placed vertically. Oviposition extended over nearly two months, from the 28th March. A table showing the results of opening the tunnels in the horizontal logs in March, April, May and June is given, with their respective measurements at those dates. The first larvae were discovered on 21–23 April, i.e. 17–19 days after the beginning of oviposition; they began to bore into the wood on the 2nd May. On the 22nd May the larvae of *M. minor* were observed to be attacked by larvae of Cerambycids and some other insects, including another Scolytid, *Crypturgus cinereus*, and to a very small degree by *C. pusillus*. The borings of *C. cinereus* were observed on 2nd May. The larvae of *C. cinereus* feed in and on the bark, and pupate in the bark. The next generation of adults of *C. cinereus* was found on 25th July, their life-cycle having lasted about 81 days. It is thought that the destruction of *M. minor* by *C. cinereus* is effected mechanically by crushing the eggs and larvae when the tunnels of the former cross those of the latter. The cycle of development of *M. minor* is divided into eight stages: (1) egg, (2) larva underneath the bark, (3) larva in the

cocoon, (4) pupa, (5) young beetle in the cocoon, (6) winged adult injuring shoots, (7) wintering adult, and (8) ovipositing adult. Of these stages, in only 1, 2, and 8 are control measures practicable.

Myelophilus piniperda, L., was on the wing from 23rd March to 7th April; oviposition began on 26th March and continued till 11th May; the first larvae were observed on 26th April and about a month later all the larvae were already in the bark, the first pupae appearing on 25th May and the first beetles on 13th June. The adult *M. piniperda* remains for a longer time in the galleries than that of *M. minor*, but eventually emerges and attacks the pine shoots. There is some evidence that these beetles, as in the case of *M. minor*, hibernate and oviposit a second time.

Ips sexdentatus, Börn., was on the wing from 25th April to 1st May, when oviposition began; the first larvae were observed on 19th May, the last ones on 7th June; pupae were found between 8th June and the middle of July. Young beetles underneath the bark occurred from the middle of June to the middle of August. The old beetles do not remain in the galleries, but emerge and most probably oviposit a second time. The beetles of the second generation began to bore themselves in on 12th June.

KAPPER (O.). *Ocneria monacha*.—« Лѣсной Журналъ.» [*Forestry Journal*], *Petrograd*, xlv, no. 10, 1915, pp. 1420–1459.

This is the first instalment of a review of the biology and control of *Lymantria (Ocneria) monacha*. In Russia this insect first attracted notice in the fifties of the last century, when it destroyed many hundreds of square miles of forests; it has been reported from 30 governments of European Russia, the northern limit being 58° N. Lat. and the Southern one, 54° N. Lat.; it has also been recorded from Irkutsk in Siberia. The females oviposit in August underneath the bark of trees, where the eggs remain over the winter; their vitality is very great and according to some authors they are able to withstand intense frost and even a long submersion in water; Dr. Metzger obtained caterpillars from eggs subjected to a treatment with 4 per cent. carbolic acid, in order to destroy possible bacteria of flacherie. In autumn the eggs are more sensitive to climatic conditions, and dry, hot weather in August and September may delay their development. The young caterpillars are fully formed in four weeks and winter inside the eggs, emerging in spring at a temperature of about 57° F. Hatching continues for about a month. There are four or five moults; the reason for this discrepancy is not known, but it may have some relation to sex, for the individuals that moult only four times give rise to a larger proportion of females. The newly hatched caterpillars are mainly found along the borders of forests, where the buds are earlier; they exhibit great vitality at this stage and in a dry atmosphere can withstand a temperature of 19° F., or even 10° F., for several hours. They are polyphagous, feeding on fir, pine, oak, ash, etc. They exhibit a preference for trees growing in low-lying situations, which may account for their tendency to spread to such places. According to Ebermaier, there exists a direct relation between the amount of evaporation and the ash content of leaves, and the same trees may contain a different amount of ash according to whether they grow in high or low places. Although

deciduous trees contain more ash than pines and firs, the latter are preferred owing to the pitch they contain. A tendency to attack the healthiest trees is also exhibited. The pupal stage lasts two weeks and the adults appear in the middle of August, the males emerging before the females and in greater numbers. Oviposition occurs chiefly on trees with rough bark, but in large outbreaks may be effected anywhere on the trunks and branches. The majority of observations tend to show that dense woods are preferred for oviposition. Large outbreaks of *L. monacha* appear to occur at intervals of six years. Instances of large migrations are common and are mainly due to climatic conditions. The moths have been known to travel as much as 12½ miles unassisted by the wind. Such migrations can hardly account for sudden and extensive damage to forests, which is more probably due to the insects having been present for some time and gradually increasing to abnormal numbers.

In the author's experience, the chief damage by this insect is done to spruce growing in valleys, the eggs being laid preferably on coniferous trees, especially the larger ones. They are chiefly found at heights under 19 feet; between 19 and 38 feet the number of eggs decreases considerably, and above this only single eggs are found; the presence of pines amongst these plantations favours the development of the caterpillars. The next place is taken by spruce trees amongst alder woods, where the insects concentrate on the former; the majority of eggs in this case were observed at a height not exceeding 10–14 feet. Spruce plantations on very swampy ground are injured to a much less degree; the greatest number of eggs was found at a height not exceeding 11–24 feet, but the degree of infestation in these circumstances is very small.

Benzin (Vassily). **Агрономическій поѣздъ Владикавказской желѣзной дороги.** [The Agronomical Train of the Vladikavkaz Railway].—**«Сельское Хозяйство и Лѣсоводство.»** [*Journal of Agriculture and Forestry*], *Petrograd*, ccli, no. 6, June 1916, pp. 161–179, 12 figs.

This is a description of the agricultural instruction-train run by the Vladikavkaz Railway, which contains a section relating to applied entomology, with particulars of posters, pamphlets, figures of pests, insecticides, fungicides, sprayers, etc., etc.

Kolesnikov (Alexander). **Лѣсоводственное и финансовое значеніе бѣлой акаціи въ степномъ лѣсоразведеніи.** [The importance of white acacia in steppe-afforestation from the point of view of forestry and finance.]—**«Сельское Хозяйство и Лѣсоводство.»** [*Journal of Agriculture and Forestry*], *Petrograd*, ccli, no. 6, June 1916, pp. 191–234.

The author deals with that part of the steppe-afforestation in Russia which, in the second half of last century, was connected with the endeavour to cultivate white acacia (*Robinia pseudacacia*) with special reference to some areas of the Verchnednieprovsk Forests, in the govt. of Ekaterinoslav. During late years these plantations have suffered largely from *Eulecanium* (*Lecanium*) *capreae*, which fact is

at variance with the prevalent idea that this tree is not liable to attack by insect pests. The injuries were first noticed in 1908 and 1909 on the branches and trunks. The damaged shoots die off, this process starting at the tip and young plants being mostly attacked. Where this scale is present in large numbers, other plants, such as *Euonymus europaeus*, are attacked, though oaks are apparently immune. The scales hatch in July and reach their normal size in the following spring. The life-history and control of this pest requires further study, as well as its relation to the varieties *inermis* and *umbraculifera* of this tree. It is also stated that in 1890 the plantations of white acacia in this forest were seriously damaged by some unidentified Geometrid caterpillars. In the south, the seeds of white and yellow acacia and of *Lathyrus silvestris* are frequently attacked by the caterpillars of the Pyralid, *Etiella zinckenella*, Tr., which penetrate into the pods and devour the seeds.

VASSILIEV (Prof. E.). **Боярышница.** [*Aporia crataegi*, L.]—**« Подольскій Хозяинъ.»** [*The Podolian Farmer*], *Vinnitza*, no. 5–6, May–June 1916, pp. 12–13.

Aporia crataegi has one generation a year, the pupal, adult, and egg stages occurring during May and June, while the caterpillars are present throughout the remaining 10 months. The chief damage is done by the hibernated caterpillars in April and May, before pupation. The eggs are laid on the upper surface of the leaves of medlars, apple, pear, plum, blackthorn, walnut and less frequently oak; they have been found exceptionally on leaves of transplanted beet. It is suggested that the destruction of the winter nests of this pest, as well as those of *Euproctis chrysorrhoea*, should be compulsory. In May and June it is advisable to watch the trees on which oviposition is effected and to remove infested leaves and destroy the eggs by crushing or by throwing the leaves into kerosene or naphtha.

Къ вопросу о примѣненіи въ садоводствѣ желѣзнаго купороса въ соединеніи съ известью. [On the question of the application in horticulture of iron sulphate in combination with lime.]—**« Русскіе Субтропики.»** [*Russian Subtropics*], *Batoum*, ix, no. 4–5, pp. 84–85.

Experiments on spraying fruit trees with a solution containing 11 lb. of iron sulphate, 11 lb. of lime and 9 oz. of Paris green in 135 gallons of water, gave good results against *Hyponomeuta malinellus* and other gnawing insects. Neither fruit nor foliage suffered damage, but the spray proved ineffective against fungus diseases, such as *Leptosphaeria lucilla* on pear leaves. This preparation may be used with success for smearing tree-trunks, as it destroys moss and lichen as well as scale-insects and fungi, if some such disinfectant like carbolic acid or carbolineum is added. For the latter purpose a solution of the strength of about 25 lb. of iron sulphate and 12–14 lb. of lime in 135 gallons of water was effectively used in 1914 without injuring the green parts of the plants. Scorching caused by iron sulphate solution is attributed to the presence of free sulphuric acid in the commercial product, of

which even a 0·5 per cent. solution causes scorching. The addition of lime neutralises the free acid and in combination with iron gives hydrates which are beneficial to the trees. The best indicator to use for determining the alkalinity of the mixture is phenolphthalein paper, litmus being quite unreliable.

Ol (I. A.). **Мѣры борьбы съ щитовкой на тернѣ.** [Remedies against a scale-insect on black-thorn.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 29, 30 July 1916, pp. 702-703.

Lepidosaphes ulmi, L., is very common in European Russia, breeding on apple, pear, plum, thorn, peach, medlar, willow, service tree, etc. The best remedy is California mixture applied in autumn, or in spring before the swelling of the buds. To prepare California mixture, 10 lb. of slaked lime, 10 lb. of flowers of sulphur and 3-6 gallons of water are heated together till the whole turns amber-yellow, when about 5 lb. of common salt, dissolved in water, is added and the mixture heated for another 1½ hours; sufficient water to bring the total volume of the liquid up to 22-27 gallons is finally added. At the moment when the young larvae emerge in spring from underneath the shields, which can be ascertained by watching a piece of bark kept in a glass, they can be controlled by spraying with kerosene-emulsion, repeating it three times at intervals of one or two days.

Ol (I. A.). **Борьба съ яблонной тлей.** [The control of *Aphis pomi*, De Geer.]—**«Прогрессивное Садоводство и Огородничество.»** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 30, 6th August 1916, pp 718-719.

The control of *Aphis pomi* consists in the destruction of the eggs in late autumn and winter by cutting away and burning infested shoots, or by spraying with California mixture; or spraying in spring, before the leaves have been curled, with quassia emulsion or tobacco decoction with soap. Quassia emulsion is prepared by boiling 3 lb. of quassia shavings in about 6 gallons of water for two or three hours and adding 2-3 lb. of soft soap dissolved in a small quantity of water to the strained liquor. Tobacco extract is prepared as follows:—1-2 lb. of dry leaves and stems are steeped in 3 gallons of water for 4-6 days and then boiled in the same water for 3-4 hours, strained, and made up to 2-4 times this volume with water; 3 lb. of soap is added to each 3 gallons of the extract.

Donetzky. **Луговой мотылекъ и мѣры борьбы съ нимъ.** [*Phlyctaenodes sticticalis* and its control.] — **«Хозяйство на Дону.»** [*Husbandry on the Don*], *Novotcherkassk*, xi, no. 11, 25th June 1916, pp. 492-494.

An outbreak of caterpillars of *Phlyctaenodes sticticalis* is recorded and the immediate application of spraying with Paris green is urged. The usual remedies are given, including cultivation of the ground during the pupal stage, destroying the adults by burning dry grass etc., and the destruction of weeds serving for oviposition.

Sands (W. N.). **Native Food Plants and Feeding Habits of the Cotton Stainer in St. Vincent.**—*Agric. News, Barbados*, xv, nos. 369 & 370, 17th June & 1st July 1916, pp. 202–203 & 218.

Injury to cotton by *Dysdercus delauneyi*, Leth. (cotton stainer) in St. Vincent has been followed during the past three years by a fungus disease of the bolls which has resulted in serious loss. Investigations have been carried out relating to the feeding habits and native host plants of the bug, in order to devise new methods of control other than by hand-picking. Cotton plants are usually pulled up and burned by the end of February and the new crop is planted in May. During the interval the insects feed on flowers of *Mangifera indica* (mango), *Eupatorium odoratum*, *Cordia cylindrostachys* (black sage), and *Moringa pterygosperma* (horse radish tree), on the fruit of *Hibiscus esculentus* (okra) and *Mormordica charantia*, and on secretions of scale-insects, but do not seem able to breed on these hosts. *Eriodendron anfractuosum* (silk-cotton tree) and *Thespesia populnea* (John Bull tree) are more important than the above hosts, in that they form breeding places and thus furnish a supply of insects for the infestation of the new cotton crop. *E. anfractuosum* occurs chiefly in the Leeward district near the coast. Male and female insects appear on the trees at the end of February, at the time when the young bolls begin to swell. Young insects are found at the beginning of April on damaged bolls both on the tree and on the ground, and later occur on seeds on the ground. The latter form a source of food until the cotton crop is ready. The examination of injured bolls has failed to show the presence of the fungus causing internal boll disease. *E. anfractuosum* does not flower every year and is therefore only periodically a source of danger. It should either be destroyed or pruned back as soon as the flowers are seen. *T. populnea* occurs extensively in a part of the Windward district, and in smaller numbers in the Leeward district. Breeding takes place very freely on this tree during April. It should therefore be treated in the same way as the previous species. Natural enemies of the cotton stainer include several birds and a mite.

Cacao Thrips and Die-Back in St. Vincent.—*Agric. News, Barbados*, xv, nos. 369 & 370, 17th June & 1st July 1916, pp. 206–207 & 222–223.

A number of cacao estates in St. Vincent were visited by the Entomologist and Mycologist for the purpose of investigating the status of *Heliothrips rubrocinctus* (cacao thrips) in these districts. On one estate, two periods of abundance of thrips occurred during the year, one in April and May, in the dry season, and the other in September and October, in the wet season. Two conditions among unhealthy or dead trees were observed :—(1) trees which were attacked by a root disease due to the fungus *Rosellina* sp.; (2) trees which were dead or dying and had been severely attacked by thrips, the dead branches being infested with *Diplodia* (die-back fungus). This disease was also found both in young and mature trees, and trees thus affected were very susceptible to injury by thrips.

Certain remedial measures are suggested for trees suffering from *Diplodia*. Shade plants, such as banana, tannia and *Gliricidia* should

be allowed to develop an abundant top shade. *Aralia guilfoylei* planted closely should afford a very effective screen. A definite system of manurial treatment should be followed. The following routine is suggested:—First year: pen manure; second and fourth year: mulch, leaves and bush; third year: cotton-seed meal and basic slag.

THEOBALD (F. V.). **Notes on New and Little Known British Aphides. ii.**—*Entomologist, London*, xlix, no. 639, August 1916, pp. 182–185, 1 fig.

The following species are described:—*Siphocoryne alboapicalis*, sp. n., on *Malva* spp. in Kent; *Aphis plantaginis*, Schrank, on *Plantago* spp., *Daucus carota, Viola* spp., *Chrysanthemum leucanthemum*, etc., throughout England; *Brachycolus stellariae*, Hardy, on *Stellaria holostea* and *S. graminea*; and *Lachniella nigrotuberculata*, Del Guer., on *Larix leptolassa*, in Lancashire.

HARRISON (J. W. H.). **Coccidae and Aleyrodidae in Northumberland, Durham, and North-East Yorkshire.**—*Entomologist, London*, xlix, no. 639, August 1916, pp. 172–174.

The following species of COCCIDAE are recorded:—*Aspidiotus britannicus*, Newst.; *Chionaspis salicis*, L.; *Eriopeltis festucae*, Fons.; *Asterolecanium variolosum*, Ratz.; *Eulecanium* (*Lecanium*) *ciliatum*, Doug.; *Physokermes abietis*, Geoff.; *Dactylopius hibernicus*, Newst.; *Eriococcus devoniensis*, Green; *Fonscolombia fraxini*, Kalt.; *Ortheziola vejdovskyi*, Sulc.; *Orthezia cataphracta*, Shaw; *O. urticae*, L.; *Newsteadia floccosa*, De Geer.

The species of ALEURODIDAE recorded are:—*Aleurochiton aceris*, Geoff.; *Aleurodes lonicerae*, Walk.; *A. prolitella*, L.; *A. rubicola*, Dougl.; *A. brassicae*, Walk. and *A.* (*Asterochiton*) *vaporariorum*, Westw.

KHARE (J. L.). **A Longicorn Beetle (Cerambycid) Feeding on Orange Trees.**—*Jl. Bombay Nat. Hist. Soc., Bombay*, xxiv, no. 3, 20th June 1916, pp. 610–612. [Received 3rd August 1916.]

This Longicorn, *Stromatium barbatum*, F., has been recorded from Assam, North-west India, Ceylon, Burmah, Mauritius, Madagascar, etc., where it infests forest trees such as teak, *Acacia catechu, Dendrocalamus strictus*, mango, and bamboo. In the present instance, a larva, believed to be that of *S. barbatum*, was taken from the hole bored by the larva of a moth (*Arbela*) in the green branch of an orange tree. This species usually bores in the wood of dead trees. Adults emerge in June and July, and the females oviposit in cracks in the bark. The entire larval period and the pupal stage are passed inside the tree. The minimum duration of the life-cycle is from 1½ to 2 years. It is recommended that old orange trees which are infested should be removed and destroyed; wounds and cracks in the bark should be painted over with a mixture of beeswax, resin and linseed oil.

DUTT (H. L.). *Agrotis* **at Colgon and Ghogha.**—*Agric. Jl., Dept. Agric., Bihar and Orissa, Patna*, iii, no. 2, October 1915, pp. 33–40, 1 map. [Received 3rd August 1916.]

The Andrés-Maire trap was used during 1913–14 against *Agrotis ypsilon* attacking rabi crops in the Bhagalpur district. During 1913, traps were working between 9th September and 23rd December at Ekchari and between 17th September and the latter date at Tawrar. In the former locality, marked success attended the use of the traps and no damage from *A. ypsilon* was noted; in the latter, injury was limited to about 12½ acres. The number of moths captured during the season was 45,465, of which 26,652 were females. During 1914 a certain loss in the crops was reported from both localities; this was however partly due to the abnormal drought between the end of September and January. Traps were used on a larger scale than in the preceding year; at Ekchari the number of moths caught was 23,535, of which 10,469 were females. The results of the campaign have had the effect of slightly increasing the value of the land and of bringing into cultivation land which has been lying waste owing to former ravages by this moth.

DUNCAN (R. S.). **Dust Sprayer Tested in Mr. Gibson's Orchard.**—*Canadian Horticulturist, Peterboro, Ont.*, xxxix, no. 7, July, 1916, p. 166, 2 figs.

The dust spray tested on orchard trees consisted of a mixture of 85 per cent. sulphur and 15 per cent. lead arsenate. The quantity used for each tree varied from 1 to 2 lb. for each application. No opinion can yet be given on the value of this spray. The chief advantage is the ease and rapidity with which the spray can be applied. Application should be made on a calm day at the same dates as those on which liquid sprays are generally used.

COAD (B. R.). **Cotton Boll-Weevil Control in the Mississippi Delta, with Special Reference to Square Picking and Weevil Picking.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 382, 8th July 1916, 12 pp.

The heavy rainfall prevailing in the delta region of the Mississippi favours the survival of the cotton boll weevil [*Anthonomus grandis*] in fallen squares. Tests were therefore made to determine the value of collecting hibernating weevils from the plants in spring and of destroying fallen squares. In 1915 square-picking was begun on 16th June and was repeated at intervals of seven days until 14th July. Comparison with a control plot showed an increase of 23 per cent. of seed cotton in the picked plot. Beneficial results were obtained by the collection of weevils from standing plants, by shaking them into sacks held below the plant and later destroying them by means of water covered with a layer of kerosene. This method proved to be superior to hand-picking, since, in the latter, weevils were liable to be overlooked or to fall to the ground when the plant was disturbed. When however the cost of labour was taken into consideration, the margin of profit appears to be too slight to render these measures of commercial value.

SMITH (L. B.). **Second Report on Insecticides for the Control of the Colorado Potato Beetle** (*Leptinotarsa decemlineata*, Say).—*Virginia Truck Expt. Sta., Norfolk*, Bull. no. 17, 1st October 1915, pp. 369–376, 2 tables. [Received 5th August 1916.]

Various insecticides were tested as to their value in controlling larvae and adults of *Leptinotarsa decemlineata*. Five sprayings were made between 19th May and 19th June inclusive; the number of living beetles was counted before, and 24, 48 and 72 hours after spraying. The results showed that 91·8 per cent. of the adults and 90·9 per cent. of the larvae were killed by a spray consisting of 50 U.S. gals. home-made Bordeaux mixture, 4 lb. lead arsenate, and 1 lb. Paris green. No injury to the foliage was observed. Zinc arsenite paste, at the rate of 2 lb. to 50 gals. Bordeaux mixture, destroyed 80·7 per cent. of adults and 87·7 per cent. of larvae. The poison acted rapidly and did not injure the foliage. This preparation is recommended for general use. Calcium arsenate, at the rate of 5 lb. paste to 50 gals. Bordeaux mixture, was tested, with the result that 78·2 per cent. of adults and 66·5 per cent. of larvae were killed. This compound may in future prove of much value as an insecticide, since it did not injure the leaves, showed marked adhesive properties and was cheaper than lead arsenate. Several proprietary compounds also gave satisfactory results.

SURFACE (H. A.). **The Striped Stalk Borer.**—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 29, 27th July 1916.

Papaipema nebris (*nitela*) (striped stalk borer) injures potatoes, tomatoes, dahlias, chrysanthemums, etc. The only method of control is to cut and burn infested plants and weeds growing near them. Weeds should be mown three or four times a year to prevent the insect from reaching maturity.

KUWANA (S. I). **Some New Scale Insects of Japan.**—*Annotationes Zoologicae Japonenses, Tokyo*, ix, no. 2, June 1916, pp. 145–152, 1 plate. [Received 5th August 1916.]

The following new scale-insects are described:—*Protopulvinaria japonica* on *Fatsia japonica*; *Asterolecanium bambusicola*, *A. hemisphaericum* and *A. masuii*, on bamboo; *A. litseae* on *Litsea glauca*; *A. tokyonis*, on *Pasania cuspidata*; and *Nipponorthezia ardisiae*, gen. et sp. n., on the roots of *Ardisia japonica*.

BUTTRICK (P. L.). **Another Insect Enemy of the White Pine.**—*Amer. Forestry, Washington, D.C.*, xxii, no. 271, July 1916, pp. 395–396, 4 figs.

This article gives information regarding the pine sawfly *Lophyrus pini*, L. (*similis*, Hart.), which has already been abstracted [see this *Review*, Ser. A, iv, p. 242].

GLASER (R. W.) & CHAPMAN (J. W.). **The Nature of the Polyhedral Bodies found in Insects.**—*Biol. Bull., Marine Biol. Lab., Woods Hole, Mass.*, xxx, no. 5, May 1916, pp. 367–390, 3 plates. [Received 5th August 1916.]

Polyhedral diseases are known to occur in nature in the caterpillars of the following Lepidoptera:—*Hemileuca maia*, Dru., *Apantesis virgo*, L., *Cirphis (Leucania) unipuncta*, Haw., *Agrotis unicolor (Noctua clandestina*, Harr.), *Phytometra (Autographa) brassicae*, Riley, *Lymantria (Porthetria) dispar*, L., *L. monacha*, L., *Hemerocampa (Orgyia) leucostigma*, S. & A., *Malacosoma americana*, F., *M. disstria*, Hb., *Bombyx mori*. L., *Phryganidia californica*, Pack., and *Colias philodice*, God. Several forms of disease can be distinguished, each of which is characterised by a special type of polyhedra. The size of the polyhedra varies very considerably in different species of insects, but there is a marked similarity in shape. Wilt disease of gipsy moths, army worms, etc., is caused by a filterable virus and it is believed that the polyhedra arise as a reaction against the invasion of this virus. The latter disintegrates the nuclear material of certain tissue cells in such a way that polyhedral bodies are synthesised from the disintegrating proteins. The polyhedra are therefore not living organisms which are responsible for the disease.

EHRHORN (E. M.). **Report of the Division of Entomology [for March, April, May 1916]**—*Hawaiian Forester & Agriculturist, Honolulu*, xiii, no. 6, June 1916, pp. 195–202. [Received 11th August 1916.]

The following pests were among those intercepted between March and May:—From Japan: *Aulacaspis (Diaspis) pentagona* on flowering cherry trees. From Manila:—A larva of a weevil, *Acythopeus aterrimus*, in the stem of a *Phalaenopsis* orchid. From Philadelphia:—A green Psyllid on *Buxus*; *Ischnaspis longirostris* (thread scale) on *Ixora*; and *Pseudococcus longispinus* (mealy bugs) on *Pandanus*.

Parasites reared and liberated included:—*Tetrastichus giffardi*, *Diachasma fullawayi*, *D. tryoni* and *Opius humilis*.

O'GARA (P. J.). **A New Mite from the Hawaiian Islands.**—*Science, Lancaster, Pa*, xliv, no. 1126, 28th July 1916, p. 142.

A new species of *Eriophyes* is recorded from the undersurface of the leaves of *Litchi chinensis* in Hawaii. Injury resulted in a curling of the leaves. The mite may be of Hawaiian origin, as it has not been recorded from China, whence the plant was imported.

HARRIS (W.). **Report of the Superintendent of Public Gardens.**—*Ann. Rept. Jamaica Dept. Agric. for the Year ended 31st March 1916, Kingston 1916*, pp. 4–12.

The oleander scale [*Aspidiotus hederae*] is troublesome on oleanders in Hope Gardens, but is kept in check by occasional sprayings of lime and sulphur wash. *Cosmopolites sordidus*, Chevr. (black weevil borer of bananas) attacked bananas near Castleton Gardens. The plants in the infested area were dug out, chopped up, and buried in pits three

feet square and one foot deep, covered with six inches of soil which was beaten firm; in each pit was placed 2 oz. of carbon bisulphide. Subsequent examination showed that all insects and their larvae had been killed in the pits. Banana plants in the gardens and adjoining lands were dug out, chopped up and buried in deep trenches. In the infested area the weevils and their larvae were found only in old decaying stumps and stems.

Ritchie (A. H.). **Report of Entomologist for Year 1915-1916.**—*Ann. Rept. Jamaica Dept. Agric. for the Year ended 31st March 1916, Kingston 1916*, pp. 31-34.

The black fly of citrus, *Aleurocanthus woglumi*, Quaint., has continued to spread and during the past year has been reported from two of the largest citrus groves in the island. This Aleurodid appears capable of doing greater damage than *Aleurodes* (*Dialeurodes*) *citri*, R. & H., and *A.* (*D.*) *citrifolii*, Morg., combined, as, unlike these white-flies of Florida, it breeds during the entire year. The Florida citrus spray of Diamond paraffin oil and whale oil soap is effective against it, two sprayings at a short interval being advisable at first. *Lepidosaphes beckii*, Newm. (purple scale) finds the shade and protection it prefers on trees infested by *A. woglumi* and their combined effect is most harmful. *Chionaspis citri*, Comst. (white scale) is general, and untended trees are in some localities being killed out by the abundance of this insect. *Chrysomphalus aonidum*, L. (*ficus*, Ashm.), *Parlatoria zizyphus*, Lucas, *Fiorinia fioriniae*, Targ., *Parlatoria pergandei*, Comst., *Pseudaonidia articulatus*, Morg., have also been present on the material examined. *Eriophyes oleivorus*, Ashm. (rust mite) was not a serious pest during the past season. A species of *Pachnaeus*, probably *P. distans*, *Lachnopus aurifer*, *Prepodes* (*Diaprepes*) *vittatus* and *Diaprepes* sp. have also been taken injuring the leaves of citrus. The services of a black ant [*Cremastogaster brevispinosa*, Mayr, var.] have been enlisted against *A. woglumi*, so far with success. This ant occurs naturally on logwood, building its nests in the forks of branches, and the nests have been transferred one to each citrus tree. Numerous cacao trees with root systems impaired by root-infesting grubs were blown completely over by the hurricane of last autumn. While much has been written concerning the injury done by *Prepodes vittatus* ("Fiddler"), the author's investigations tend to show that a species of *Lachnosterna* is most concerned. At the present time grubbing of the roots is the control resorted to, the cost being about one penny per tree per year. *Heliothrips* (*Selenothrips*) *rubrocinctus*, Giard (red-banded thrips) seriously attacked and defoliated cacao, especially in dry localities or during dry weather. The Florida citrus spray (at strength of 1 in 50) or Black Leaf 40 (at strength of 1 in 2,000 with 3 lb. of soap added to each 100 gals. of spray) appear to be the most satisfactory remedies. Two sprayings at short intervals are necessary. Injury to the epidermis of cacao pods by the minings of what is probably an Agromyzid have been noticed recently. *H. rubrocinctus* also extensively injured mango leaves and fruit. The leaves of the growing tips blacken, curl and drop off, while in extreme cases there is total defoliation. Attack arrests growth and the fruit is generally small and inedible. The punctured areas subsequently form the point of attack of various fungi. *Anastrepha*

fraterculus, Wied. (mango fly), was severe in some localities on the summer mango crop and was appearing again on the spring crop. Its preference for certain varieties requires study. The destruction of fallen fruit and the cultivation of the surface soil beneath the mango trees have been recommended. *Alabama argillacea*, Hb. (cotton caterpillar) was heavily parasitised in the autumn by *Chalcis annulata*, F. Dusting with bags of Paris green was generally practised against this insect in the cotton areas. *Saissetia nigra*, Nietn. (black scale) and *Hemichionaspis minor*, Mask. (white scale) were abundant wherever cotton was grown. Insecticidal control is necessary, as the action of the Hymenopterous parasites of these scales is very feeble at present. In the drought prevailing in the Vere sugar-cane areas in spring and early summer 1915, *Stenocranus saccharivorus*, Westw. (cane-fly) was general and greatly interfered with the young cane. Old cane was badly blackened by the consequent sooty mould. Fine weather caused *S. saccharivorus* to disappear. The larvae of *Erinnyis ello*, L., caused extensive damage to cassava in St. Elizabeth and South Manchester. The later larvae were heavily parasitised by *Apanteles americanus*, Lep. *Horismenus apantelivorus*, Crawf., and a Pteromalid were also bred from them. Where cassava was just making its first growth at the time of the outbreak, the plants received a serious set-back and in some places were killed. It is advisable therefore to delay planting till just after the season for these caterpillars, so that plants will have made a maximum growth before the following outbreak. Under the conditions prevailing, hand-picking the caterpillars was the cheapest method of control. Protection of the parasite's cocoon masses and scuffling the soil to expose the pupae of the moth were also advised. The Cling Cling (*Quiscalus crassirostris*) assembled in the cassava fields during the St. Elizabeth outbreak and rendered most valuable assistance. *Lonchaea chalybea*, Wied. (bud maggot) was present everywhere, and a red spider was responsible for a spotting of the leaves. The Longicorn, *Lagochirus obsoletus*, Thom., which is such a formidable pest in Cuba, is happily not yet present in Jamaica. *Euscepes batatae*, Waterh. (sweet potato scarabee) was most destructive to sweet potato in the arid districts of St. Elizabeth, while in the vale of St. Thomas *Cylas formicarius*, F. (sweet potato weevil) caused the loss of 25 per cent. of the crop. St. Vincent yam tubers from the Stony districts were heavily infested with the scale, *Targionia hartii*, Ckll. In November in the Pedro Plains district, there was an outbreak of the locusts, *Schistocerca pallens*, Thunb.; and *S. inscripta*, Walk., in which maize and other crops suffered. The Katydid, *Neoconocephalus guttatus*, Serv., was also present. In the autumn of 1915 the cricket, *Gryllus assimilis*, F., became very abundant and vegetables and flowers when newly planted out were much damaged. Tobacco was also attacked, but the Kansas poison bait here proved effective [for other insect pests of tobacco see this *Review*, Ser. A, iv, p. 153]. Maize was attacked even before it germinated and a loss of 100 per cent. occurred in some instances. Though not entirely satisfactory, red lead applied wet as a seed coating is the best repellent known at present. Coal tar, which has been advocated, only permits of 10 per cent. germination. *Laphygma frugiperda*, S. & A. (fall army worm) seriously defoliated maize in certain localities and attacked sugar-cane on two estates. On one of these the land was flooded and the injury ceased. The

Tachinid parasites, *Frontina aletiae*, Riley, and *Archytas piliventris*, Wulp, were bred out and the percentage of parasitism was high. *Chloridea (Heliothis) obsoleta*, F. (corn earworm) seriously damaged maize in some localities, in one instance 90–100 per cent. infestation of the cobs occurred. The ears were subsequently heavily infested in the fields by *Calandra granaria*, L., and in one sample *Silvanus surinamensis*, L., was most abundant. *Diatraea saccharalis*, F. (stalk borer) was present in specimens from St. Mary and Clarendon. The destructive wood-boring Bostrychid, *Apate terebrans*, Pall., was noticed attacking *Pithecolobium saman*, *Cajanus indicus* (Congo pea), *Persea gratissima* (avocado), etc. *Caryoborus* sp. and *Calandra linearis*, Herbst. caused considerable damage to the pods of *Tamarindus indica* (tamarind). Specimens of the fungus, *Cordiceps sphecocephala*, Klotzch, growing on, and killing wasps of the genus *Polistes*, were sent in. The fungus, *Isaria barberi*, parasitic upon *Diatraea saccharalis* was collected at Chapelton. The presence of *Cosmopolites sordidus*, Germ. (black banana weevil) in the island was recorded in November 1915 [see this *Review*, Ser. A, iv, p. 175]. From Glengoffe and Spanish Town complaints of infestation of hives by *Galleria mellonella*, L. (wax moth) were received.

CLÉMENT (A. L.). **Les insectes du saule.** [Insect pests of the willow.] —*La Vie Agric. et Rur., Paris*, vi, no. 32, 5th August 1916, pp. 99-103, 10 figs.

According to Bellevoye more than 450 species of insects live on the willow. In this article only the most injurious ones are briefly dealt with.

Coleoptera :—*Melolontha melolontha*, *Phyllopertha horticola*, *Anomala frischi*, *Agrilus viridis* and *Cryptorrhynchus lapathi*. The last-named is the most injurious of the weevils infesting the willow. The bark of the branches mined by the larva becomes brown and splits and the branches themselves break in the wind. All infested branches, whether on the tree or on the ground, should be collected and burnt. The adults may be shaken down on to sheets. The adults of the Longicorn, *Saperda carcharias*, may be collected in the same manner, while the larva of this beetle, which remains within the trunk and branches for two years, may be killed by closing the holes with plugs soaked in carbon bisulphide, benzine, etc. In the nurseries the young stems may be covered with a mixture of cowdung and clay to a thickness sufficient to prevent oviposition on the bark. The larvae of *Lamia textor* and *Aromia moschata*, which resemble those of *S. carcharias* and have the same habits, may be destroyed in the same way. A Chrysomelid, *Melasoma (Lina) populi*, oviposits on the leaves, which are devoured by the larvae. There are two or three generations annually, the last one hibernating and ovipositing in the following spring. Shaking the insect on to sheets and spraying are the controls advised. Two other Chrysomelids, *Phyllodecta vitellinae* and *P. vulgatissima*, appear from April to July or August. There are two generations a year, the second hibernates and then oviposits in the spring, when the young larvae attack the buds and, later on, the leaves. The beetles may be caught in shelter-traps and then burnt. Against the larvae, dusting with quicklime is recommended, followed by a spray of a nicotine solution

prepared as follows: 10 lb. of black soap is dissolved in 4–5 gals. of hot water and 2 lb. of sodium carbonate is dissolved in 1 gal. of water; the two solutions are mixed and 1 gal. of spirit, 2 gals. of tobacco extract and 95 gals. of water are added. The adults can also be collected with the Haltica funnel. Arsenicals may also be used against these beetles. These control measures may be applied against *Galeruca* (*Galerucella*) *capreae* and *Galerucella lineola*, as well as against *Plagiodera armoraciae* and various species of *Haltica*.

Hymenoptera :—The larvae of *Cimbex*, *Hylotoma*, and of many species of *Nematus* feed on the leaves of the willow; those of other *Nematus* live within the leaf-galls produced by them, while *Sirex* larvae live in the wood like Longicorn larvae. The larvae of *Pontania* and many of those of *Cryptocampa* live in the petioles and in the buds, causing various malformations. The controls given above may be used against all these pests.

Lepidoptera :—The larvae of *Pieris rapae*, *Apatura ilia*, *Vanessa polychloros*, *V. antiopa*, *Sphinx* (*Smerinthus*) *ocellata* and *Amorpha* (*S.*) *populi* occur on the willow, but do not do noticeable injury. The larva of *Aegeria* (*Sesia*) *apiformis* mines the trunks of willows and poplars and requires the same treatment as Longicorn larvae. Collection and destruction of infested twigs is the control advised in the case of *Aegeria* (*Sesia*) *formicaeformis*. The larva of *Earias chlorana* binds the terminal leaves in a bundle, within which it devours the bud and stem. The nymphal stage is passed in a cocoon on the branches. The leaf-bundles should be gathered and burnt before the larva emerges. The wood-eating larvae of *Cossus cossus* (*ligniperda*) and *Zeuzera pyrina* (*aesculi*) attack willows, the former the trunk and the latter the branches. *Lymantria dispar*, *Euproctis chrysorrhoea* and *Stilpnotia salicis* injure willows and should be controlled by means of light traps and by scraping off the eggs, which may also be painted over with tar. The larva of *Dicranura vinula* also occurs on the willow, as well as various Noctuids, Geometrids and Microlepidoptera.

Rhynchota :—Various Cercopids, Aphrophorids and Tettigonids suck the sap and may be destroyed by repeatedly spraying with a 2 per cent. black soap solution, or with a solution containing 2 per cent. black soap and 2 per cent. nicotine. These sprays are also effective against *Aphis saliceti* and *Melanoxantherium* (*Melanoxanthus*) *salicis*; and with the addition of 2 lb. of sodium carbonate and 1 gal. of spirit per 100 gals. of insecticide, these solutions are useful against *Kermes salicis*.

Diptera :—*Rhabdophaga rosaria* and *R. pulvini* are two Cecidomyids which injure willows. The larva of the former lives in a kind of gall at the tip of the branches, while that of the latter causes the young twigs to wither; these must be cut off and burnt.

Several species of *Eriophyes* (*Phytoptus*) attack the leaves and the twigs of willows and may at times do important damage. These mites may be controlled by cutting and burning infested material and by using nicotine sprays.

PORTIER (P.) & SARTORY (—). **Sur un *Spicaria* nouveau, isolé de la chenille de *Cossus cossus*; *Spicaria cossus*, n. sp.** [A new *Spicaria* from the larva of *Cossus cossus*; *Spicaria cossus*, sp. n.]—*C. R. Soc. Biol., Paris*, lxxix, no. 14, 22nd July 1916, pp. 700–701, 1 fig.

In the mines of *Cossus cossus* the young larvae have been sometimes found to be in a mummified condition and to have the appearance of silk-worm larvae killed by a Muscardine fungus. The fungus concerned, *Spicaria cossus*, sp. n., is described and figured.

PORTIER (P.) & SARTORY (—). **Sur une forme de *Botrytis bassiana*, isolée de la chenille de *Nonagria typhae*.** [A form of *Botrytis bassiana* from the larva of *Nonagria typhae*.]—*C. R. Soc. Biol., Paris*, lxxix, no. 14, 22nd July 1916, pp. 702–703.

If larvae of *Nonagria typhae*, which feed on the pith inside the stems of *Typha latifolia*, are killed and kept in a sufficiently damp place, they will be found to mummify and to become covered with a form of *Botrytis bassiana*.

SILVESTRI (F.). **Contribuzione alla conoscenza del genere *Poropoea*, Förster (Hymenoptera, Chalcididae).** [A contribution to the knowledge of the genus *Poropoea*, Förster.]—Separate, dated 2nd August 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xi, pp. 120–135, 9 figs.

This note deals with two species of the genus *Poropoea* found in Italy, the larvae of which are beneficial, because they destroy the eggs of two injurious Coleoptera. *P. stollwercki*, Först., parasitises the eggs of *Attelabus nitens*, Scop. (*curculionoides*, L.), the adults of both insects appearing in the second half of April and early in May. As soon as the egg-tubes, which the beetle makes with leaves of *Quercus ilex* and other trees, are formed, the Chalcid oviposits in them. The Chalcid larva attains full growth in six or seven days. The complete life-cycle from egg to adult occupies 14 or 15 days, in May. The adults of the first generation appear from mid-May onwards up to about mid-June. The larvae do not transform into pupae on attaining full-growth; this takes place in the following April, the larvae having hibernated in the egg-tubes. *P. stollwercki* may destroy up to 50 per cent. of the eggs of *A. nitens* and is therefore of some importance in control. *Ophioneurus simplex*, Ratz., *Trichogramma simplex*, Rheinh., and *Ophioneurus grandis*, Thompson, are synonyms of *P. stollwercki*.

P. defilippii, Rond., in litt., was observed parasitising *Byctiscus betulae*, L., by De Filippi, who placed it in the genus, *Ophioneurus*. The synonyms of this species are: *Ophioneurus filippii*, Rond., and *O. signatus*, Ratz. Its parasitic habits are probably similar to those of *P. stollwercki*. Adults were obtained between 1st and 10th June from tubes of *Byctiscus* collected between 20th May and 3rd June. Others were obtained up to 17th June from tubes collected on 5th June. *P. defilippii* is known to occur in Italy in Piedmont, Liguria, Umbria and in the province of Bari.

Vincent (—). Staphylinid injurious to Turnips in France.—*Internat. Rev. Science & Pract. Agric. (Mthly. Bull. Agric. Intell. Plant Dis.), Rome*, vii, no. 4, April 1916, p. 623. [Abstract from *C. R. Séances Acad. d'Agric. France, Paris*, ii, no. 4, 26th January 1916, pp. 87–88.] [Received 20th September 1916.]

In the department of Finistère turnips have suffered from the attacks of a Staphylinid beetle. Good results were obtained against it with toluene and still better with benzine at the rate of 8·8 gals. per acre. A rotation of crops would however probably be a more economical measure.

Krause (A.). *Tinea cloacella*, injurious to Dried Edible Mushrooms.—*Internat. Rev. Science & Pract. Agric. (Mthly. Bull. Agric. Intell. Plant Dis.), Rome*, vii, no. 4, April 1916, p. 623. [Abstract from *Zeitschr. Först- u. Jagdwesen, Berlin*, xlviii, no. 2, February 1916, pp. 73–78.] [Received 20th September 1916.]

In March 1915 a quantity of dried mushrooms received from Eberswalde were found to be infested with Lepidopterous larvae. The first adult appeared on 9th April and was identified as *Tinea cloacella*; most of the adults appeared in May. The eggs were always deposited singly on the mushrooms.

Papageorgios (P.). The "Fruit-fly" (*Ceratitis capitata*) injurious to Citrus in Greece.—*Internat. Rev. Science & Pract. Agric. (Mthly. Bull. Agric. Intell. Plant Dis.), Rome*, vii, no. 4, April 1916, p. 623. [Abstract from *Deltion, Vasilikis Georgikis Etaireias, Athens*, vii, no. 12, pp. 258–260, 1 fig.

Ceratitis capitata caused considerable damage in 1915 among citrus trees in Attica and Epirus. The collection of infested fruit and their treatment with lime is advised against the larvae, while the adults may be poisoned with grape syrup containing a 5 per cent. solution of arsenate of soda. This bait should be placed in tins hung among the branches.

Cowley-Brown (P. C.) & Burkill (I. H.). Locusts in Malacca; July 1914 to October 1915.—*Gardens' Bull., Straits Settlements, Singapore*, i, no. 10, 10th July 1916, pp. 335–349, 5 figs.

During the period under consideration, locust breeding places were most numerous around two centres, Alar Gajah and Jasin, but also occurred at less frequent intervals throughout the territory. The species concerned was *Locusta (Pachytylus) migratorioides*. Records of hatching in various districts showed that no emergence took place between December and March, probably as a result of the dryness of the soil. A further comparison of rainfall statistics and hatching records showed that the rate of hatching decreased in any half month when the local rainfall was very heavy. This may have been due to the fact that a temperature too low for the development of the eggs may have resulted from rapid evaporation from the soil. The largest number of breeding places were found in rubber plantations and in lalang waste land. The latter is regarded as forming dangerous foci, whence the rice lands on the coastal plains may become infected.

QUINN (G.). **The Orange in South Australia.**—*Jl. Dept. Agric., South Australia, Adelaide*, xix, no. 11, June 1916, pp. 967-980. [Received 17th August 1916.]

The most serious pests of orange trees in South Australia are the scale-insects *Chrysomphalus (Aspidiotus) aurantii*, Mask., and *Saissetia (Lecanium) oleae*, Bernh. The former species can be controlled with kerosene emulsion, resin wash or hydrocyanic acid gas. If fumigation is used, 1 oz. potassium cyanide and 1 oz. sulphuric acid should be allowed for every 100 cubic feet enclosed, and treatment should continue for not less than 45 minutes. *S. oleae* occurs chiefly on dense, strongly growing trees. Such trees should be thinned out and sprayed with kerosene or oil emulsion. The orange aphis attacking young shoots in spring may be destroyed by the use of kerosene emulsion or tobacco and soap wash. This Aphid is usually controlled by a parasitic Ichneumonid. Injury to leaves and twigs of young trees by the weevil, *Otiorrhynchus cribricollis*, may be prevented by placing a band of woolly sheep skin round the trunk of the tree or by spraying with lead arsenate solution at the rate of 1 lb. lead arsenate paste to 8 gals. water.

MASKEW (F.). **Quarantine Division; Report for the Month of May 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 7, July 1916, pp. 270-272.

The following insect pests were intercepted:—From Australia: A Coccid on Kentia palm. From the Azores: *Lepidosaphes beckii* and *Pseudococcus* sp. on lemons. From British Columbia: *Chionaspis pinifoliae* on a conifer. From Central America: *Aspidiotus cyanophylli*, *A. palmae*, *Pseudococcus* sp., and *Chrysomphalus scutiformis* on bananas. From China: *Phomopsis citri* on pomelos; weevil larvae in sweet potatoes, and *Aulacaspis rosae* on an unknown plant. From Hawaii: *Diaspis bromeliae*, *Pseudococcus bromeliae*, and *Saissetia* sp. on pineapple, *Coccus longulus* on betel leaves, *Cylas formicarius* in sweet potatoes, and Trypetid larvae in mangoes. From Japan: weevil larvae in sweet potatoes, and *Ceroplastes rubens* on camellia. From New Jersey: *Cerataphis lataniae* on palms; and *Pseudococcus* sp., *Pulvinaria* sp., *Chrysomphalus aonidum* and the weevil, *Ampeloglypter* sp., on orchids. From Oregon: larvae of *Epochra canadensis* in gooseberries, and *Aleurodes* sp. on ornamental plants. From Alabama: *Pseudococcus* sp. on *Coleus*. From Arizona: weevil larvae in acorns. From Cuba: *Pseudococcus bromeliae* on pineapple. From Illinois: *Pseudococcus* sp. on *Coleus*. From Massachusetts: *Euthrips* sp. on lemon trees. From Mexico: *Chloridea obsoleta* on tomatoes, and *Lepidosaphes gloveri* on oranges. From New York: *Pseudococcus* sp. and Aphids on gardenias. From Ohio: *Orthezia insignis* on *Strobilanthus dyerianus*; and *Pseudoccocus* sp., *Saissetia hemisphaerica*, and *Coccus hesperidum* on crotons. From Pennsylvania: Aphids on chrysanthemum plants; *Pseudococcus* sp. on roses, and *Chrysomphalus aonidum* on lilies. From Wisconsin: *Pseudococcus adonidum* (*longispinus*) and *Coccus hesperidum* on crotons.

Simanton (F. L.). The Terrapin Scale: an Important Insect Enemy of Peach Orchards.—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 351, 22nd April 1916, 96 pp., 19 figs., 3 plates, 44 tables. [Received 24th August 1916.]

Eulecanium nigrofasciatum, Perg., is confined to the eastern parts of the United States, being especially abundant in Pennsylvania and Maryland. In Canada, it has been found on maple in Ontario. About 30 kinds of plants are attacked, the most important of which, arranged in order of preference, are peach, plum, maple, cherry, sycamore and mistletoe. There is one generation annually, the winter being passed in the immature female stage. Activity is resumed in spring, maturity being reached during June, when reproduction begins. The reproductive period continues for about a month, but in some instances may be prolonged for 3½ months. Young emerging from the parent scale migrate to the leaves. About six weeks later, young females pass to the twigs, whither they are followed after a week by the males. After pairing, the females grow rapidly for two or three weeks; activity then gradually diminishes until the insects pass into the dormant winter state. The date at which hibernation ends is determined by weather conditions. Experiments conducted at Mont Alto, Pennsylvania, showed that in 1913 activity was resumed about 1st April. Growth was rapid for a month, then proceeded more slowly. All females under observation reached maturity by 10th June. A vigorous female may give rise to as many as 900 young. The time spent after birth within the brood chamber varied from one to three days. In 1912, the first young appeared in the brood chamber on 6th June and began to emerge on 8th June; emergence ceased by 17th July. More extended observations made in 1915 showed that the rate of emergence reached a maximum five days after the beginning of migration and then rapidly declined. Migration took place between 10 a.m. and 3 p.m. of each day, migrating larvae being able to live for two or three days without food. Dispersal during the migratory period may be effected: (1) by the dropping of larvae from dead branches, fruit, etc.; (2) by wind; (3) by rain; (4) by other insects, birds, labourers, etc. Mortality at this time was found to be very small and only 15 out of 12,336 larvae were unsuccessful in finding attachment to the underside of leaves. The first instar was completed in from 16 to 17 days in July 1913 and in 25 days in August 1912. A certain amount of dispersal may probably occur during this time, since larvae on detached, drying leaves are able to move on to living foliage. The second instar, passed on the leaves, lasted for 18 days under favourable conditions. Migration to the twigs during the third instar began about 1st August, reached a maximum before the middle of the month, then continued gradually until the falling of the leaves. Passage took place during the hottest part of the day, i.e., between about 12.30 p.m. and 3 p.m. and ceased almost entirely below 70° F. Larvae which failed to become attached to the twigs were unable to survive for more than three days. It is probable that passage from one tree to another cannot be effected unless the branches of the two are actually in contact. The final position taken up was found to be on the twigs, preferably on the basal part of the young growth, though many became attached to older wood. The maximum quantity of honeydew was secreted during the

first 25 days of fixation, but it continued to be formed to a slight extent until hibernation. In 1913, the first deposit was observed on 4th August and reached a maximum on 23rd August. By the first week in September the leaves, fruit and branches were covered with a layer of honeydew and black fungus spores. Hibernation began about 12th November; the mortality during this period was less than 10 per cent. at Mont Alto, but on poorly nourished trees amounted to 54 per cent.

The following species of ants were attracted by the honeydew of the female scale:—*Formica truncicola*, Nyl., subsp. *integra*, Nyl.; *F. fusca*, L., var. *subsericea*, Say; *Lasius niger*, L. var. *americanus*, Emery; *Prenolepis imparis*, Say. During the process of migration to the twigs, female larvae were attacked by several predaceous enemies. The lacewing, *Chrysopa nigricornis*, Burm., the larvae of *Hemerobius stigmaterus*, Fitch, the Capsid bug, *Camptobrochis nebulosus*, Uhl., and the Coccinellids, *Hyperaspis signata* and *Chilocorus bivulnerus* (twice-stabbed lady-bird), were of minor importance in this connection. The predaceous Pyralid, *Laetilia coccidivora*, Comst., was present in considerable numbers in 1913, and under favourable conditions should prove of importance in controlling *E. nigrofasciatum*. The eggs are deposited singly among the scales, probably during the first half of June, and hatch in about six days. A silken tube is constructed between the scales of gravid females, and beneath this the larvae feed and construct cocoons. The pupal period lasted about 10 days. Adults emerge in August and give rise to a second generation which attacks the young females. The effectiveness of this Pyralid is however greatly lessened owing to the fact that it is heavily parasitised by *Mesostenus thoracicus*, Cress., and an undescribed species of *Habrobracon*. The Coccinellid, *Hyperaspis binotata*, Say, caused heavy mortality in both 1912 and 1913 among young scales [see this *Review*, Ser. A, iv, p. 282]. Parasitic enemies mainly attack female scales after the second instar. *Coccophagus lecanii*, Fitch, was abundant in 1912, but in 1913 its place was taken by *C. cognatus*, Howard. The latter species attacked developing females in the spring, causing a mortality of from 20 to 50 per cent. Emergence from the host occurred about 30th June. Later, the same species destroyed about 5 per cent. of males in the second instar. *Aphycus stomachosus*, Gir., was reared from nearly mature females early in June and again from individuals of the next generation in September. *Blastothrix sericae*, Dalm., and examples of a new genus of ENCYRTIDAE were also reared. The following additional parasites of *E. nigrofasciatum* have been recorded: *Coccophagus ater*, How.; *C. cinguliventris*, Gir.; *C. longifasciatus*, How.; *C. flavoscutellum*, Ashm.; *C. fraternus*, How.; *Aphycus annulipes*, Ashm.; *A. johnsoni*, How.; *Anagyrus nubilipennis*, Gir.; *Eunotus lividus*, Ashm.; *Pachyneuron altiscuta*, How. (secondary); *Prospalta aurantii*, How.; *Chiloneurus albicornis*, How., and *Comys fusca*, How.

The growth of sooty moulds on the honeydew reaches a maximum about the middle of September, and hence the most serious injury is caused to late ripening varieties of peaches.

A series of experiments was undertaken to determine the most suitable methods for controlling *E. nigrofasciatum*. During the first season efforts were made to prevent soot injury both by controlling

the fungus in the presence of the living scale and by destroying the scale itself. Attempts in the first direction failed. Against the scale, a number of substances were tested, and as a result, the following recommendations for control are given :—(1) Spraying in spring before the buds open with the following emulsion :—5 gals. raw linseed oil, 3 gals. gasoline, 2 lb. soap, 92 gals. water ; or with proprietary miscible oils containing not less than 75 per cent. mineral oil, at the rate of 1 part to 16 to 20 parts water ; (2) spraying just before the migration to the leaves with 10 lb. flour, 15 lb. stone lime, 20 lb. sulphur, 50 U.S. gals. water.

A bibliography of 76 papers on the terrapin and other scale-insects is appended.

Insect Pests in Manitoba.—*Canadian Horticulturist, Peterboro, Ont.*, xxxix, no. 8, August 1916, p. 205.

Shade and ornamental trees in Manitoba have suffered severely from insect attack during the past two years. Aphids and cankerworms have been mainly responsible for the death of from 30 to 50 per cent. of the maples in the Province. Nicotine sulphate and lead arsenate respectively have been used against these pests. *Galerucella decora* has been injurious to poplar, willow, cottonwood, etc., in various localities, while black and white spruce were attacked by the spruce gall louse [*Chermes abietis*]. Cutworms have proved to be the most important pest of vegetable crops, grain, and lucerne.

TRYON (H.). **Bean Fly and other pests.**—*Queensland Agric. Jl., Brisbane*, vi, no. 1, July 1916, pp. 34–35.

The best known method of controlling *Agromyza phaseoli* consists in burning the bean plants after the crop is gathered. Eggs present on the leaves, etc., are thus destroyed. Ammoniacal liquid has been shown to be attractive to the fly. Experiments are being carried out to determine the value of this and other compounds as controlling factors. It is suggested that sowing should take place in July and August, since the numbers of the insect decrease with the low temperatures at the end of the year.

JARVIS (E.). **Grub Stage of the Cane-Beetle.**—*Queensland Agric. Jl., Brisbane*, vi, no. 1, July 1916, pp. 35–36.

During the end of April and the beginning of May climatic conditions were favourable for the development of *Metarrhizium anisopliae*. This fungus caused considerable mortality among mature larvae of *Lepidiota albohirta*. It is recommended that all larvae parasitised in this way should be left on the ground or if possible broken up and buried in the furrows, in order that infection may be disseminated. Experiments on the control of the larva by poisoning were completed during June, but no details are given of the conclusions reached.

JARVIS (E.). **Sugar-Cane Pests.**—*Queensland Agric. Jl., Brisbane*, vi, no. 1, July 1916, pp. 36–37.

The common cane beetle [*Lepidiota albohirta*] was present in considerable numbers in the Highleigh and Babinda areas. *L. caudata* was found at Deeral but caused no serious injury. The native food-plant of this species is *Paspalum platycaule* (carpet grass) and the life-cycle occupies two years. The Noctuid, *Mocis frugalis*, F., caused defoliation of sugar-cane at Meringa and Gordonvale during March, while a second brood occurred in June. The moth is well-controlled by natural enemies and is not likely to become a serious pest.

WALTON (W. R.). **The True Army Worm and its Control.**—*U.S. Dept., Agric., Washington, D.C.*, Farmers' Bull. no. 731, 23rd May 1916, 12 pp., 8 figs. [Received 26th August 1916.]

This paper gives a popular account of the habits, life-history and methods of control of *Cirphis* (*Heliophila*) *unipuncta*, Haw.

HOLLOWAY (T. E.). **Larval Characters and Distribution of Two Species of *Diatraea*.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 16, 17th July 1916, pp. 621–626, 1 fig., 1 plate.

The summer and winter forms of the larvae of *Diatraea saccharalis crambidoides*, F., and *D. zeacolella*, Dyar, are described. The former species occurs in Mexico, the Gulf States and the Mississippi Valley on sugar-cane, maize and grasses. Larvae in the first instar feed on the leaves of the host, but in later stages are found within the stalks. *D. zeacolella* has been recorded from North and South Carolina and Virginia on maize. This species differs from the preceding in that it penetrates into the tap-roots of the host, whereas *D. saccharalis crambidoides* is confined to the aerial stems.

MALLOCH (J. R.). **A New Species of *Agromyza* destructive to Beans in the Philippines.**—*Proc. Entom. Soc., Washington, Washington, D.C.*, xviii, no. 2, June 1916, p. 93. [Received 26th August 1916.]

Agromyza destructor, sp. n., is described. This species often causes serious damage to young beans and cowpeas in the Philippines.

MILLER (D.). **Control of the New Zealand Flax Grub.**—*Jl. Agric., Wellington, N.Z.*, xii, no. 6, 20th June 1916, pp. 446–451. [Received 22nd August 1916.]

The Geometrid, *Xanthorhoe praefectata*, causes most serious injury to flax [*Phormium tenax*] in the Makerua Swamp on the left bank of the Manawatu River. Injury occurs in both the wet and drier portions of the swamp, and the abundance of the insect is not dependent on the regularity or irregularity of floods. Attack is mainly confined to those bushes around the roots of which dead leaves, etc., have collected. Feeding takes place at night or on dull, wet days, direct sunlight having an injurious effect on the larvae. Movements are apparently influenced to some extent by temperature, but the insect is able to exist in districts in which severe frosts occur. Birds, especially the swamp-hen and

starling, are probably an important controlling factor, since larvae are usually rare in those localities in which these birds are abundant. Live-stock are useful in clearing the ground of undergrowth in which the larvae can hide during the daytime, and in this connection the pasturing of sheep on infested areas is suggested. Further investigations on the life-history of *X. praefectata* would be necessary before the last-named operation could be successfully carried out. Predaceous insects occurring in the same areas as *X. praefectata* apparently do not control the latter to any appreciable extent. The parasites of this pest require further investigation. In the absence of flax, larvae have been found on other plants, including bulrushes, and these may therefore be of importance in determining methods of control [see also this *Review*, Ser. A, iii, p. 302].

Pest and Diseases of Cotton and their Control.—*West Indian Bull., Barbados*, xv, no. 4, 1915, pp. 315–318. [Received 2nd August 1916.]

During the fifth day's proceedings of the West Indian Cotton Conference, held in March 1916 in St. Kitt's, some points remaining from the previous discussion on pests and diseases of cotton [see this *Review*, Ser. A, iv, p. 384] were considered. A most unusual outbreak of cockroaches occurred in St. Kitt's, the insect eating down young cotton plants in the fields. Crickets and grasshoppers to a less extent, also did some injury in St. Kitt's. These were controlled with a poisoned bait. Damage was done in Anguilla by a grey weevil [*Lachnopus*], which gave trouble in Antigua, Tortola and Nevis. It attacks the cotton plant when very small; a poisoned bait is the only remedy yet suggested against it. The weevils often hide among the foliage at the tips of the branches of the cotton plants where they may be collected.

The juice of ripe oranges is considered to be probably the best trap for cotton-stainers, *Dysdercus*. In Montserrat and St. Vincent, the two islands in which internal boll disease attracted most attention, the prevailing species of cotton-stainer is not the one prevalent on St. Kitt's. When cotton growing was first started in the West Indies, the species most abundant in Montserrat was *Dysdercus andreae*, which was common in St. Kitt's and also occurred in Antigua, and in the north and west of Jamaica; this is now no longer the case. The predominant species in Montserrat is the southern form, *D. delauneyi*, which occurs alone in Grenada and St. Vincent, and which perhaps occurs in the Virgin Islands in company with *D. andreae*. In St. Vincent, where the greatest trouble has been experienced, *D. delauneyi* is the pest concerned. The destructive powers of *D. andreae* (white stainer) and *D. delauneyi* (red stainer) appear to be equal. Internal boll disease has been known in Antigua for many years, though *D. delauneyi* does not occur there.

Mr. Harland related his experience with the use of starch and Paris green [see this *Review*, Ser. A, iv, p. 42]. While vegetation dusted with lime is avoided by insects, it was found that a mixture of Paris green and low-grade arrowroot or cassava starch in the proportion of 1 to 60 can be spread very thinly and that cotton worms (*Alabama argillacea*) will eat it at once. While lime is easily dissolved by rain-water, starch is more adhesive. In experiments with maize, lime

mixtures were found to be useless, the lime itself doing severe damage to the heart of the maize; mixtures of arsenic and starch in proportions of 1 to 30 or 1 to 40 were however effective. Mr. Ballou said that Paris green and lime in the proportion of 1 to 6 should not render the leaves repellent to the cotton worm and this was the proportion used in most of the islands. With regard to the point that Montserrat was infested with cotton worms from Antigua, Mr. Ballou said that the powers of flight of the moth were extraordinarily great and it was becoming the general opinion in America that the cotton worm did not hibernate in the United States, but that every outbreak was the result of fresh invasion. It is not certain that this moth does not hibernate in some of the West Indian islands, and it is very likely that an island without a close season, like Antigua, would enable them to survive better than one like Montserrat, which has a close season.

BERLESE (A.). **Entomophagous Insects and their Practical Employment in Agriculture.**—*Internat. Rev. Science & Practic. Agric.* (*Mthly. Bull. Agric. Intell. Plant Dis.*). *Rome*, vii, no. 3, March 1916, pp. 321-332. [Received 2nd August 1916.]

The action of natural entomophagous enemies of insect pests is not always so clearly defined as in the case of *Novius cardinalis* and *Icerya purchasi*. The increase of pests is subject to a number of factors, and entomophagous enemies do not always play the most important part. These enemies are divided into predatory species, which hunt and devour other insects or their eggs, and endophagous species, which develop in the body of the victim or in its eggs, or which devour the eggs within the mother. Both groups include monophagous insects, which only attack one species, and polyphagous insects, which attack several species. As a general rule endophagous insects are more useful than predatory ones, and polyphagous less so than monophagous. The first section of this paper deals with entomophagous insects with useful action in the absolute sense, *i.e.*, against insect pests of agriculture. The two most striking instances of this are provided by *N. cardinalis* against *I. purchasi* and by *Prospaltella berlesei* against *Aulacaspis* (*Diaspis*) *pentagona* [see this *Review*, Ser. A, i, p. 189; ii, pp. 292, 403; iii, pp. 5, 6, 251, 256, 524]. In both cases the beneficial species, imported some time after the harmful one, has been free from its own enemies, as found in its native country. Another, but less definite instance, is furnished by the Chalcids imported into the Hawaiian Islands to combat the Australian Fulgorid, *Perkinsiella saccharicida*, very injurious to sugar-cane [see this *Review*, Ser. A, iii, p. 758].

The second section of this paper deals with entomophagous insects of mediocre efficacy and intermittent in action. Their useful action is less sure, less constant and less uniform, either because they are themselves attacked by other entomophagous species or by other adverse factors, or because their victims are chiefly controlled by other special factors. The following are examples of insects belonging to this category:—*Scutellista cyanea* against *Saissetia* (*Lecanium*) *oleae*, *Cryptolaemus montrouzieri* against various scale-insects; *Orcus chalybeus* and other Coccinellids against *Aspidiotus perniciosus*; and *Hippodamia convergens* against *Eriosoma* (*Schizoneura*) *lanigerum*.

Generally speaking, predatory species are much less efficient as destroyers of other insects, either because they are themselves attacked by other entomophagous insects or because they are usually polyphagous. They do not persist until the last individual of the species attacked has been destroyed, but migrate when food begins to become scarce. Though species attacked by predatory enemies are therefore subject to periods of great destruction, they also have intervals during which they multiply very rapidly and may be very injurious.

Other more or less successful experiments with beneficial insects include the introduction into the United States of *Apanteles glomeratus* from England against *Pieris rapae* [see *Review*, Ser. A, iii, p. 277], of and *Calosoma sycophanta* from Europe and *Schedius kuvanae* from Japan against *Lymantria dispar* and *Euproctis chrysorrhoea* [see this *Review*, Ser. A, iii, p. 507]. BRACONIDAE and TACHINIDAE were introduced into British Columbia in 1914 against *Cirphis* (*Heliophila*) *unipuncta* and *Phytometra* (*Plusia*) *californica*. *Calosoma sycophanta* was introduced into Sumatra in 1913, against *Phryganidia californica* and *Chloridea* (*Heliothis*) *obsoleta*. In 1909–1910 a Chacidid, *Trichogramma* (*Pentarthron*) *carpocapsae*, Ashm., was introduced into Turkestan against *Cydia pomonella*, but with little effect, the extent of parasitism not exceeding 2 per cent. A Tachinid, *Ceromasia sphenophori*, was introduced into Honolulu against *Metamasius hemipterus*, a weevil attacking sugar-cane; according to Swezey, as many as 87 per cent. of the injurious insects were destroyed. The value of the parasites that have been imported into the United States against *Anthonomus grandis* is considered to be great. Silvestri is acclimatising Hymenopterous parasites of *Dacus oleae* (olive fly) in Italy.

In conclusion, it is considered unreasonable to expect that an insect imported into a new locality can succeed in neutralising the effects of an injurious species indigenous to that locality, unless there is reason for crediting the existence in the world of a region where the said species, though injurious elsewhere, is agriculturally harmless. If so, it is in this region that the fundamental cause of this desirable state of affairs should be investigated. The importation of the enemies of an injurious insect is not, however, always without danger, as it may disturb a state of equilibrium. The study of the injurious insect, or of its allies, will provide data enabling a conclusion to be drawn as to the existence of enemy organisms capable of diminishing its numbers. In many cases natural control will be found to be of no practical value and waste of time may be avoided by employing artificial methods, while in others, certain endophagous insects, which elsewhere attack some very injurious species with very considerable practical success, might be introduced to control the same pests or species allied to them. For example, the importation from America into Europe of certain Diptera (*Sarcophaga cimbicis*, Towns., *S. hunteri*, Hough, and others) said to be very efficacious against grasshoppers, should be of material use in Italy. Other American species of value in Europe would be the Chalcid, *Telenomus ashmeadi*, parasitising *Pentatoma ligata*, and allied species; Tachinids of the genus *Admontia*, parasitising TIPULIDAE; Hymenoptera (*Polygnotus*, etc.) against *Mayetiola destructor* and other Cecidomyids injuring wheat. The field is a vast one, and so far, practically unexplored.

RUMSEY (W. E.). **Some Common Insects and Plant Diseases of the Farm, Garden and Orchard.**—*West Virginia Dept. Agric., Charleston*, Bull. no. 17, May 1916, 38 pp., 71 figs. [Received 15th August 1916.]

This bulletin deals briefly with the common insect and plant diseases, each pest being briefly mentioned. A section on insecticides and fungicides is added.

Boll Weevil Quarantine Regulations.—*Georgia State Board of Entomology, Atlanta*, Circ. no. 19, July 1916, 11 pp., 1 map.

This circular contains the text of the boll-weevil quarantine regulations issued by the Georgia State Board of Entomology under the authority of the Georgia Quarantine Act, a copy of which is also given. The boll-weevil line extends along the points where weevils were actually found at the time of the first killing frost in 1915. The inspections of the U.S. Bureau of Entomology in Alabama, Georgia and Florida confirmed the correctness of this line. The safety line is twenty miles and the quarantine line fifty miles in advance of the actual boll weevil line. The position of these lines is shown in a sketch-map. No person except the State Entomologist, or his authorized deputy, may lawfully have in his possession outside of the weevil-infested territory any living stage or any cotton square or boll containing such stage, of the Mexican cotton boll-weevil [*Anthonomus grandis*].

PORTATE (F.). **Per la Bianca-Rossa.** [A note on *Chrysomphalus dictyospermi*, Morg.]—*Giorn. Agric. Merid., Messina*, **ix**, no. 7, July 1916, pp. 100–104.

A decrease of infestation by *Chrysomphalus dictyospermi* has been noted in Sicily. This must be due not only to applications of lime-sulphur, but also to the action of natural enemies such as *Chilocorus bipustulatus*, L., *Exochomus quadripustulatus*, L., and *Aphelinus chrysomphali*, Mercet, as reduced infestation has been observed in citrus plantations where spraying had never been carried out.

DAWE (M. T.). **Memorandum sobre la enfermedad del arroz en Villavicencio.** [A note on a disease of rice in the Villavicencio district.]—*La Patria, Bogotá*, 21th June 1916.

Rice growers in the Villavicencio district of Colombia have noticed that damage to their crop, which has been long prevalent there, has assumed an epidemic character this year. The damage is done by a small insect (so similar in appearance to a mosquito that it may be called the "rice mosquito") sucking the leaves of the rice plant. The following petroleum-soap emulsion is advised: Hard soap, $\frac{1}{2}$ lb.; water, 1 gal.; petroleum, 2 gals. For use it must be diluted with eight parts of water.

GUEYLARD (Mlle. F.) & PORTIER (P.). **Recherches sur la résistance au froid des chenilles de *Cossus* et *Carpocapsa*.** [Researches on the resistance of *Cossus* and *Carpocapsa* larvae to cold.]—*C. R. Soc. Biol., Paris*, lxxix, no 15, 29th July 1916, pp. 774–777.

The larvae of *Cossus cossus* may be frozen and yet recover full vitality when brought back to a normal temperature. A larva exposed for one hour to a temperature of 5° F. was frozen so stiff that an attempt to bend it caused it to break in two. After being held in the hand for some time, the pieces were seen to begin moving, and when the rear portion was placed in front of the mandibles, it was devoured. A rapid warming was not found to cause injury, for a larva kept at 5 ° F. for one hour and then immediately softened by dipping in water at 85° F., was alive on the following day. Repeated freezings did not affect the larvae, some of which were treated six times within a month without any apparent ill effect. The above facts applied only to experiments made in winter. During mild weather in February 1916, and again later, when some larvae were frozen at 1° F. and others in liquid air, they all died. Seasonal influence is therefore present and an actual adaptation to cold during winter is involved. A series of experiments made with the larvae of *Cydia* (*Carpocapsa*) *pomonella*, which also hibernates as a larva, yielded the same results.

FEYTAUD (J.). **Les insectes de la vigne: L'Apate à six dents; le Hanneton vert; la Grisette.** [Insect pests of the vine: *Sinoxylon sexdentatum*, Ol., *Anomala vitis*, F., *Lopus sulcatus*, Fieb.]—*Rev. Viticulture, Paris*, xlv, no. 1149, 6th July 1916, pp. 5-7, 1 coloured plate.

Sinoxylon (*Apate*) *sexdentatum* is one of the commonest Bostrychids in France [see this *Review*, Ser. A, ii, p. 196]. The second generation from August to September does the most damage. The Lamellicorn, *Anomala vitis*, appears in the adult form at the end of June and devours the foliage of the vine, willow and other plants during a fortnight. After mating the females oviposit in the ground, near the surface. The larvae live underground and feed on the roots of the vine and other plants. The larval stage lasts a year and a half, pupation taking place in March. This species is most abundant in the olive-growing regions, in sandy soils. The Capsid bug, *Lopus sulcatus* [see this *Review*, Ser. A, ii, p. 609], reaches the adult stage about the end of May and pierces the flower buds of the vine. Oviposition takes place at the end of June, the eggs being deposited in the bark of the stocks, in cracks in the vine-stakes, or in the pith of the branches. Nine or ten months later, in March or April, the eggs hatch and the young larvae, which are very agile, migrate to the grasses which grow in the vineyard. After about a month the nymphal stage is entered. Feeding is actively continued, but the grasses are abandoned by the insect, which climbs the vine-stocks and attacks the inflorescences. The early removal of grasses will cause it to starve before the vines are able to yield a good supply, but if the work is done too late, the attack will be concentrated on the vines. The removal of the bark from the stocks and the treatment of both stocks and vine-stakes with hot water will destroy many eggs. The same result will also be attained by painting with mixtures having a heavy-oil base.

Other Rhynchota injuring the vine are *Nysius senecionis* [see this *Review*, Ser. A, ii, p. 556], *Camptotelus minutus*, recorded in Algeria, and *Pyrrhocoris apterus*.

CAUSSE (P.). **L'ébouillantage contre la Pyrale et la Cochylis.** [**Hot-water treatment against** *Sparganothis pilleriana* and *Clysia ambiguella*.]—*Rev. Viticulture, Paris*, xlv, no. 1150, 13th July 1916, pp. 30–31.

Some information supplementing that in a previous article [see this *Review*, Ser. A, iv, p. 383] is given. The hot-water treatment is best carried out rather late and is then the most successful method against the vine pyralis [*Sparganothis pilleriana*]. A vineyard treated early in April was almost free of infestation, though surrounded by other vineyards which were completely ravaged. Like all work done to vines, the application of hot-water requires care. The work should never be done in a north wind, as evaporation is too quick and the fall of temperature too great. By using jugs an increase of temperature of from 6° to 8° F. is obtained. The jugs yield water at 205°–208° F., while a sprayer with tube and nozzle does not give more than 200°–202° F., and often less than 195° F.

LABERGERIE (—). **La Cochylis et ses habitats préférés, notamment les genévriers.** [*Clysia ambiguella* and its preferred habitats, particularly juniper trees.]—*Rev. Viticulture, Paris*, xlv, no. 1153, 3rd August 1916, pp. 71–72.

While much advice has been given on the control of *Clysia ambiguella* on vine-stocks, little has been said with regard to its destruction on other plants, on which it flourishes unchecked. Its abundance near woods has been noticed and stress has been laid on the favourable conditions afforded by the dampness in such localities. Very little attention has been drawn to its rapid spread on all plants with flower-clusters, such as heath, briar, etc. Other plants also require attention, especially juniper trees. As far as the author is aware, juniper trees have never before been recorded as hosts of *C. ambiguella*, but in certain cases the entire plant has been found covered with cocoons and webs.

KEHRIG (A.) & MÉNÉGAUX. **Les Oiseaux dans les Vignes du Sud-Ouest.** [Birds in the vineyards of South-West France.]—*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, no. 7, July 1916, pp. 74–77.

Bird protection in vineyards is stated to be the most efficient and economical method of insect control and the one which entails the least labour. Though birds are of little use in controlling extensive outbreaks once these have gained ground, their timely action at the first appearance of a pest will often suppress the beginnings of a serious infestation. No species of bird has been found to be really injurious to vines. Special efforts should be made to attract to vineyards linnets and tits, among which *Parus major*, L., is the species deserving the most attention.

MIGNONE (A.). *Recurvaria nanella*, **Micro-lepidopteron injurious to Fruit Trees in Italy.**—*Internat. Rev. Science Pract. Agric.* (*Mthly. Bull. Agric. Intell. Plant Dis.*), *Rome*, vii, no. 5, May 1916, p. 771. [Abstract from *Rendiconti R. Accad. Lincei, Rome*, xxv, 3, 1916, pp. 188–195.] [Received 13th October 1916.]

Recurvaria nanella, Hb., was noticed near Rome in March 1915 living on nearly all the fruit-bearing Rosaceae. The adults appear in the second half of June, becoming more numerous in the first half of July. By day they shelter in crevices in the bark. The small, red-brown larvae appear towards the end of August and chiefly attack the leaves of peach and apricot, and to a less extent cherry, sour cherry, apple, quince and pear. The almond and hawthorn are not attacked. The larvae feed on the parenchyma of the leaf, leaving the epidermis untouched. On the approach of winter they take refuge in crevices in the bark and hibernate in a cocoon. At the time that the blossoms appear in spring, the young larvae emerge and bore into the flower-buds a little above the point of attachment to the peduncle. Leaf-buds are also injured, the minute leaves being bound up with silken threads which impede normal development. Towards the end of April, the larva migrates from the green portions to the trunk and branches. A cocoon is spun within a crack in the bark and from this the adult emerges in June.

DALMASSO (G.). **Un poco noto microlepidottero dannoso alle piante da frutto.** [A little known Microlepidopteron injurious to fruit-bearing plants.]—*Rev. Vitic. Enol. Agrar., Conegliano*, xxii, no. 16, 15th August 1916, pp. 256–257.

This is an abstract from the original of the preceding paper.

SEBASTIANELLI (A.). **Per la lotta contro la mosca delle olive. Il concorso finanziario del Ministero di Agricoltura.** [For the control of the olive-fly. A grant from the Ministry of Agriculture.]—*La Nuova Agricoltura del Lazio, Rome*, iv, no. 79, 16th April 1916, p. 58. [Received 28th August 1916.]

The Italian Ministry of Agriculture will grant subsidies, in some cases amounting to 50 per cent. of the total cost, to associations or groups of agriculturists undertaking to combat the olive-fly [*Dacus oleae*]. The measures must be applied over the whole of a given zone of olive culture, in order to prevent reinfestation. The growers may choose the method to be employed from those which have been found reliable, but the writer of this article specially recommends the Lotrionte system [see this *Review*, Ser. A, ii, pp. 289, 452, 479].

FLETCHER (T. B.). **One Hundred Notes on Indian Insects.**—*Agric. Research Institute, Pusa, Calcutta*, Bull., no. 59, 1916, 39 pp. 20 figs. [Received 30th August 1916.]

This bulletin contains a useful summary of the life-histories and habits of a number of Indian insects and gives records of their distribution in new localities or on new food-plants. The text is supplemented by a series of figures.

The species mentioned include:—The Rutelid beetles, *Anomala aurora*, Arrow, and *A. pallidospila*, Arrow, on peach; *Adoretus lasiopygus*, Brsk., on vines; *A. versutus*, Har., on leaves of vine, fig, pear and plum; *A. horticola*, Arrow, on leaves of vine, fig, apple, pear and plum; *Xanthotrachelus faunus*, Ol., and *X. perlatus*, F., on sunflowers; *Cryptorrhynchus poricollis*, Fst., and *Alcides frenatus*, Fst., on mango; *Myocalandra exarata*, Boh., in bamboo; *Calandra linearis*, Hbst., in stored tamarind fruits; *Stromatium barbatum* in stored timber; the Dermestids, *Attagenus undulatus*, Mots., and *Trogoderma versicolor*, Creutz., in stored cereals; the Bombyliid fly, *Systoechus socius*, Wlk., predaceous on eggs of the Deccan grasshopper, *Colemania sphenarioides*; the Syrphids, *Paragus serratus*, F., and *Sphaerophoria scutellata*, F., predaceous on Aphids; the Tipulid, *Conosia irrorata*, Wied., probably a minor pest of rice; *Sesamia inferens*, Wlk., on rice, sugar-cane, maize, wheat, sorghum; *S. uniformis*, Ddgn., on sugar-cane and maize; *Calpe ophideroides*, on peaches and nectarines; *Othreis (Ophideres) fullonica*, attacking pomelo fruits; *Leucophlebia lineata*, which is a minor pest of sugar-cane and has also been recorded from Formosa and Java; *Phthorimaea operculella* mining the leaves of the egg-plant, *Solanum melongena*; *Argyroploce erotias*, Meyr., *Anarsia melanoplecta* and *Chelaria spathota*, Meyr., on mango; the Gelechiids, *Sitotroga cerealella*, Ol., *Epithectis studiosa*, Meyr., and *Aristotelia austeropa*, Meyr., in stored rice; *Laspeyresia trichocrossa*, Meyr., and *Gracilaria soyella*, van Dev., on *Cajanus indicus* (red gram); *Acrocercops ordinatella*, Meyr., a leaf-miner of camphor; *Acrolepia manganeutis*, Meyr., in stored yams; *Prays citri*, Mill., a possible pest of citrus; *Pentasobathra sirina*, Meyr., on indigo; the Indian clothes moth, *Trichophaga abruptella*, Woll., which replaces *T. tapetzella* in hot countries; the Pentatomids, *Rhynchocoris humeralis*, Thunb., a minor pest of orange and *R. plagiatus* on coca (*Erythroxylon coca*) in India and Ceylon; the Aleurodids, *Aleurodes (Dialeurodes) citri*, Riley and How., on citrus and jasmine, *A. eugeniae*, Mask., on *Eugenia*, *Aleurocanthus nubilans*, Buckt., on betel leaves (*Piper betel*), *A. piperis*, Mask., on pepper, *A. spiniferus*, Quaint., on citrus, *Neomaskellia bergi*, Sign., and *Aleurolobus barodensis*, Mask., on sugar-cane; *Liogryllus bimaculatus*, feeding on gram seeds and larvae of *Agrotis ypsilon*. *Coptotermes gestroi* is recorded from Assam. The opinion is expressed that the termite which is recorded under this name as damaging rubber in the Malay peninsula, is probably *C. curvignathus*, Holmgr.

MISRA (C. S.). **Report on Investigations regarding the Maho (*Nephotettix bipunctatus* and *N. apicalis*) in the Central Provinces.**—*Dir. of Agric., no. 2423, printed by Govt. Press, Nagpur*, 18th April 1916, 11 pp., 1 fig. [Received 30th August 1916.]

A survey of the rice-growing areas in and in the neighbourhood of Janjgir showed that *Nephotettix bipunctatus* and *N. apicalis* were more abundant on rice plants growing on land where the foliage was most succulent. Adults and nymphs in some areas were parasitised to a slight extent by a species of Dryinid. In one instance an egg-mass was found to be attacked by a Chalcid parasite; mites were seen to feed on the eggs in several cases. Predaceous enemies of nymphs and adults were apparently absent. *N. bipunctatus* and *N. apicalis*

appeared at the beginning of September and were present until the middle of November, the period of maximum activity lasting from the third week in September until the end of October. The insects were not affected by bright sunlight, and differed in this respect from the rice Fulgorids, *Sogata distincta*, Dist., *S. pallescens*, Dist., and *S. pusana*, Dist., which were present at the same period. A certain number of *Nephotettix* were captured by light-traps and bagging, but the latter method, being carried out in the flowering season, caused injury to the flower-heads. Infestation as a whole was not severe, the late varieties of rice being the most seriously injured. The advantage of sowing early varieties appears to have been realised by cultivators, who do not, however, apparently carry out control measures, such as bagging or using light traps, with any degree of thoroughness. The following measures are recommended for controlling *Nephotettix* :—(1) Bagging the fields during July and August and again in the middle of September ; (2) setting up lantern traps from the middle of September to the end of October ; (3) increasing the area of early varieties of rice under cultivation.

The following insect pests of sugar-cane were observed during the course of the above investigations :—*Scirpophaga xanthogastrella* (*auriflua*), the leaf-hoppers, *Pyrilla aberrans*, *P. pusana* and *P. perpusilla*, and a species of Dascillid. The egg-masses of the leaf-hoppers were heavily parasitised by a Chalcid.

DAVIS (J. J.) & SATTERTHWAIT (A. F.). **The False Cabbage Aphis** (*Aphis pseudobrassicae*, **Davis**).—*Purdue Univ. Agric. Expt. Sta., Lafayette, Ind.*, xviii. Bull. no. 185, May 1916, pp. 915-939, 7 figs., 4 tables. [Received 31st August 1916.]

Aphis pseudobrassicae which occurs on various Cruciferous plants, has a wide distribution in the United States, and has also been recorded from Manitoba and South Africa. This species is liable to be confused with *A. brassicae* in appearance and nature of injury. Experiments carried out in order to determine the life-history in Indiana showed that the average duration of life of the female is about 31 days. The period between birth and maturity varied from 6 to 23 days, and the reproductive period from 2 to 32 days. Natural enemies did not appear in numbers sufficient to serve as a controlling factor until late in autumn after the crops had suffered injury. *Diaeretus rapae*, Curt., and *Pachyneuron micans*, How., were reared from this Aphid, while a species of *Aphidoletes* and a Syrphid larva were predaceous on it. A fungus, *Empusa aphidis*, was prevalent among *A. pseudobrassicae* in late autumn. The most efficient insecticide was tobacco extract (40 per cent.) used at the rate of one part in 1,200 parts of water, with the addition of 4 lb. soap to each 50 U. S. gals. solution. This spray was applied to the lower side of the leaves, since the Aphids feed in that position. A rotation of crops and the destruction of wild Cruciferous plants is recommended . In greenhouses it can be controlled by spraying or by fumigation with hydrocyanic acid gas ; if the latter is used, 1 oz. potassium cyanide or $\frac{4}{5}$ oz. sodium cyanide should be allowed for every 3,000 cubic feet. Fumigation should be carried out when the temperature is not higher than 65° F.

THOMPSON (G. E.) **Sudan Grass in Kansas.**—*Kansas Agric. Expt. Sta., Manhattan,* Bull. no. 212, March 1916, 29 pp., 8 figs., 11 tables. [Received 30th August 1916.]

Sudan grass [*Andropogon sorghum*] in Kansas is attacked in warm, damp seasons by the sorghum midge [*Contarinia sorghicola*], with the result that the setting of seed is affected on all except early and late crops. The foliage is injured by grasshoppers and chinch bugs [*Blissus leucoptera*], but these pests may be readily controlled by suitable methods.

ESCHERICH (K.). *Clytus arcuatus*, **L. (Cerambycide) als schlimmer technischer Eichenschädling.** [The Cerambycid, *Clytus arcuatus*, L., an important pest of the oak.]—*Naturwissenschftl. Zeitschr. für Forst- u. Landwirtschaft, Stuttgart,* xiv, no. 6, June 1916, pp. 272–273.

The Cerambycid, *Clytus arcuatus*, L., has not been much noticed in the literature of forestry. Observations made in May 1916 in the Rhine Palatinate show that this beetle must henceforth be classed among the serious pests of the oak, its injury being about equal to that done by *Cerambyx cerdo, Platypus cylindricus* or *Xyleborus monographus.* The larva bores deep into the wood, sometimes reaching the centre of the stem, the numerous galleries greatly depreciating the value of the timber.

Zur Bekämpfung der Schädlinge und Pilzkrankheiten unserer Obstbäume. [The control of the insect and fungus pests of our fruit-trees.]—*Deutsche Landwirtschftl. Presse, Berlin,* xliii, no. 66, 16th August 1916, p. 546.

In this account of the control of fruit-tree pests it is stated that Bordeaux mixture was abandoned because of the defoliation following its use. This trouble was also noticed with too concentrated a solution of Californian lime-sulphur mixture, but ceased when the proper degree of dilution was ascertained. Winter spraying was discontinued and two applications are made, the first immediately the young shoots appear and the second after blossoming is completely over. Thoroughness in spraying is essential. The application will require to be renewed in the case of heavy rain shortly after spraying. It is noted that many insects are unaffected by strong poisons. A water-beetle, for instance, seemed quite unaffected by a cupro-arsenical solution, in which it swam and dived for over two hours.

DUPONT (R. A.). **Insect Notes.**—*Extract from Agric. Rept., Seychelles,* 1915. [MS. received from Colonial Office 24th August 1916.]

Coffee in low-lying districts was severely attacked by *Coccus* (*Lecanium*) *viridis* (green scale), but on the hills this insect was controlled to a very considerable degree by a fungus, *Cephalosporium lecanii.* The same fungus has also attacked *Eucalymnatus* (*Lecanium*) *tessellatum* on cinnamon and coconut palms in low country during the past three years. The ant, *Technomyrmex albipes,* was less abundant in those plantations in which the scale-insects were controlled by *C. lecanii,* but was prevalent in other localities. No evidence was

(C322) Wt. P1/106. 1,500. 11.16. B.& F.Ltd. Gp.11/3.

afforded for the belief that *T. albipes* prevented pollination among coconuts. *Chrysomphalus aonidum* (*Aspidiotus ficus*) caused injury in young coconut plantations; a number of parasites were reared from the scales. The following species of boring and grain beetles were recorded during the year:—*Xyleborus perforans*, Woll., on coconuts; *X. semigranosus*, Blandf., a secondary pest of cinnamon, *Albizzia lebbek* and *Eugenia jambos*; *X. abruptus*, Samp., a secondary pest of cashew, *A. lebbek* and *E. jambos*; *Crossotarsus externedentatus*, Fairm., attacking cut branches of *Pterocarpus indicus* and stems and branches of *Ficus nautarum*; *Eccoptopterus sexspinosus*, Mots., on *E. jamboso*; *Dinoderus bifoveolatus*, Woll., on all species of bamboo except *Dendrocalamus gigantea*, and in grain and flour; *Rhizopertha dominica*, F., and *Tribolium castaneum*, Hbst., in lentils; *Calandra oryzae*, L., in maize and rice; *Diocalandra frumenti*, F., on green coconut leaf-stalks.

The following scale-insects, in addition to those mentioned above, were recorded during the year:—*Gymnaspis grandis*, Green, sp. n., on husks of coco-de-mer; *Ischnaspis filiformis*, Dougl., on oil palm leaves; *Chrysomphalus* (*Aspidiotus*) *dictyospermi*, Morg., on *Jasminum*, *Thunbergia grandiflora*, *Pandanus utilis* and coconut leaf-bases; *A. lataniae*, Sign., on *T. grandiflora*, coconut leaf-bases, and fruits of bitter and bergamotte oranges; *Chrysomphalus ansei*, Green, sp. n., on coconut leaves; *Pseudaonidia* (*A.*) *trilobitiformis*, Green, on *Beaumontia grandiflora*; *Parlatoria pergandei*, Comst., on *T. grandiflora*; *Pulvinaria antigoni*, Green, on *Lantana camara* and *Melia azedarachta*; *Hemichionaspis aspidistrae* on areca nut leaves, *Dracaena* sp., and *Pandanus utilis*; *Lepidosaphes duponti*, Green, sp. n., on coconut leaf-bases; and *Cerataphis lataniae* on vanilla leaves.

NIELSEN (J. C.). **Undersøgelser over entoparasitiske Muscidelarver hos Arthropoder. V.** [Researches on Muscid larvae parasitic on Arthropods.]—*Vidensk. Meddel. fra Dansk naturh. Foren. Odense*, lxvii, 1916, pp. 9–24, 27 figs. [Received 16th August 1916.]

Many species of Geometrids occurring on oak, birch and thorn are parasitised in the larval stage by *Phorocera caesifrons*, Macq. The maggot penetrates into the host, but pupation generally takes place outside its dead body. The pupa hibernates, and there is only one brood annually. The caterpillars of *Vanessa io* and *V. urticae* are attacked by *Pelatachina tibialis*, Fln. Pupation takes place externally and the pupae hibernate. The adults of *Aelia acuminata*, L., are parasitised by *Cistogaster globosa*, Fln., which lays its eggs on the dorsal surface of the abdomen beneath the wings. On the death of the host, the parasite pupates in the earth. *Gymnosoma rotundatum*, L., and *Subclytia rotundiventris*, Fln., infest *Chlorochroa juniperina*, L., and *Clinocoris* (*Elasmucha*) *griseus*, L., respectively.

ROEPKE (W.). **Het Helopeltis-vraagstuk, in het bijzonder met betrekking tot Cacao.** [The Helopeltis question, especially in connection with Cacao.]—*Med. Proefsta. Midden-Java, Batavia*, no. 21, 1916. 40 + iii pp. [Received 22nd August 1916.]

In the dry years of 1913–1915 the damage done by *Helopeltis* in Java was as great as in 1901–02, which were also years of drought. The external differences between the two species, *H. antonii* and

H. theivora, are described; the former occurs at higher altitudes than the latter, both species being found on tea, cacao and cinchona. Oviposition usually begins soon after fertilisation, but may be greatly delayed if the conditions are unfavourable. The eggs are laid in small numbers over a long period, at the most four or five daily. The average life of the female is about a month, but it is probable that many individuals live as long as two or three months. The external factors which influence the fertility of the insect are uncertain. The eggs are laid in the soft parts of the plant, especially in the pods. In the shoots and the stems of the fruit while they are yet young and tender, they are so placed that the whole of the egg lies within the tissues of the plant, not more than four being laid in the same spot. In the case of cacao, the fine down which covers the young plant hides the projecting threads on the eggs, but a black spot develops, which enables the point of oviposition to be detected. The egg-stage lasts about six days. The larvae are active and, in the presence of suitable food, become full grown in about 10 days, moulting five times in this period. If the food-plant becomes too dry, the larvae die rapidly of hunger. The mechanical injury due to the numerous punctures is less serious than the loss of sap which results, and the poisonous effect on the plant of the salivary secretions. A list of trees and plants attacked by *Helopeltis* is given, the most important being cinchona, tea, cacao, kapok, black pepper, cinnamon, camphor and rubber (*Ficus elastica*). Numerous cultivated garden plants as well as wild plants, including various species of *Solanum*, also serve as hosts. Pods which have been badly attacked by *Helopeltis* are bored by Aegeriid larvae and other insects, which are, however, only of secondary importance. The attacks of this pest are especially serious, as the whole plantation usually suffers, and not only is the crop of fruit lost, but the health of the whole tree is seriously affected. No insect is so irregular and uncertain in its appearance as *Helopeltis*. It does not occur equally throughout the year, and in normal years there is a more or less definite maximum and minimum, the latter occurring during the second half of the east monsoon, the former in March and April. Exceptions to these rules constantly occur however, and unfortunately the experience of the past two or three years disposes of the theory that this insect cannot withstand long drought. Certain localities are regarded by the planters as foci from which the pest spreads; these are usually undisturbed places not yet brought under cultivation, well protected from the wind and in which throughout the year a certain degree of moisture is maintained. In the plantations themselves much depends on the age of the trees; cinchona only suffers seriously when the plants are young, but once attacked, the pest continues its ravages on the young leaves. In the case of cacao, both old and young plantations suffer equally. The elevation of the plantation is an important factor, the attacks being generally more serious on low-lying than on elevated ground. In cinchona plantations *Helopeltis* causes the least damage when these are enclosed and thickly planted, the attack being then generally confined to the borders. Cacao suffers most where there is the least shade, and the planters regard the *Helopeltis* question as largely one of shade, though well shaded plantations are by no means free from this pest. *Tephrosia* is the only shade plant attacked by *Helopeltis*, but it has only been a

short time in cultivation and it is as yet uncertain whether it should be kept out of the plantations. The effect of "rampassen" operations on *Helopeltis* [see this *Review*, Ser. A, Vol. I., p. 57] is probably not important, as the insects live chiefly on the buds. In laying out new plantations all foci likely to harbour *Helopeltis* should be done away with. The control of this pest is difficult. Careful and clean cultivation is very important and the trees should never be allowed to grow wild. Breeding foci and the borders of cacao plantations should be planted with *Hevea* or coffee. Catch crops between the trees should be avoided. Direct control measures consist largely in the choice of varieties of tea and cinchona which are least liable to attack, *e.g.* the fine Assam sorts in the case of tea. The existence of a resistant variety of cacao is doubtful, though some types resist better than others, and improvement in this direction might be produced by selection. In addition to birds, the natural enemies of *Helopeltis* include Mantids, Reduviids and spiders, but these, except perhaps the spiders, are not of much importance. No parasites either of the eggs or larvae are as yet known. Among insecticides, stomach poisons are of little use, there are difficulties in the employment of petroleum soap emulsion and the results are of no great value, but a thorough trial of California mixture as a repellent is desirable. Hand collection by children and burning with paraffin torches are methods of some practical value [see this *Review*, Ser. A, iii, p. 662]. Spider web and hoops covered with kapok lint and mounted on long bamboos enable the insects to be swept off the higher branches and caught. The torch method is the best on the whole, but it is not necessary, as was generally supposed, that the petroleum torch should emit a great quantity of smoke. In young plantations, only hand-collection can be safely used and the torch should only be applied, and that carefully, to those pods which are attacked by *Helopeltis* at their ends. Very young fruits may be sprayed with petroleum-soap emulsion with good effect, as this also prevents fungus attack; covering the pods with bags of paper or other material is impracticable. For more than ten years the planters have been persuaded that black ants [*Dolichoderus bituberculatus*] keep down this pest, and there is no doubt that plantations in which these ants have been encouraged to the utmost suffer but little from *Helopeltis*. Details are given as to methods of colonising these ants, including the making of artificial nests and the distribution of these in the trees. The gramang ant (*Plagiolepis longipes*) must be kept away, as it will destroy the black species.

WOLF (F. A.). **Further Studies on Peanut Leafspot.**—*Jl. Agric. Research, Washington, D.C.*, v, no. 19, 7th February 1916, pp. 891–902, 4 tables. [Received 1st September 1916.]

Leafspot disease of peanuts [*Arachis hypogaea*], due to *Cercospora personata*, may be disseminated by insects. Positive tests were given by four orders of insects, namely, Orthoptera (grasshoppers and katydids), Lepidoptera (larvae of *Chloridea* (*Heliothis*) *obsoleta*), Coleoptera (*Megilla maculata*, *Epicauta vittata*, and *Chauliognathus* sp.) and Rhynchota (leaf-hoppers). Grasshoppers were found to be capable of carrying conidia on the surface of the body for very considerable distances, and the passage of the conidia through the alimentary tract

of these insects did not affect their germination. The spores of *Puccinia cassipes*, *Alternaria* sp., and *Fusarium* sp. were also found in their excrement. The ineffectiveness of crop rotation, combined with seed treatment, in eliminating leafspot is thus probably due to the fact that wind and insects are disseminating agents.

FELT (E. P.). **Thirty-first Report of the State Entomologist on Injurious and Other Insects of the State of New York 1915.**—*New York State Mus. Bull., Albany*, no. 186, 1st June 1916, pp. 15–88, 13 plates, 22 tables. [Received 1st September 1916.]

Experiments were carried out in a number of orchards in order to determine the most favourable time for spraying against *Cydia pomonella*. The data obtained showed that the maximum control was given by a spray applied just after the blossoms fall. In three plots sprayed once at this time the number of infested apples amounted to 10·15 per cent.; in plots sprayed twice, to 8·86 per cent.; and in those sprayed three times, to 8·24 per cent. The application of two or three sprayings after the first, is also necessary to control apple scab. About nine-tenths of the infested fruit showed side-injury due to the larvae from late eggs. It is possible that a second spraying made during the latter part of June would control this type of injury to some extent.

Diarthronomyia hypogaea, H. Lw. (chrysanthemum midge) was present on greenhouse chrysanthemums at Adrian, Michigan. Injury resulted in the formation of numerous galls on the stem and leaves which rendered infested plants distorted and in many cases valueless. In Europe this species has been recorded on *Chrysanthemum leucanthemum*, *C. corymbosum*, *C. atratum*, *C. japonicum* and *C. myconis*. Breeding is probably continuous under favourable greenhouse conditions. Preference is shown for young tissues. The life-cycle is passed through within the gall and it is possible that hibernation or aestivation may occur in galls on the roots. Eggs were observed to be deposited on the leaf surface; a single female may lay from 40 to 50 eggs. The incubation period may be less than 24 hours. Periods of marked activity occur in spring and autumn. Since *D. hypogaea* is found also on *C. leucanthemum*, which is widely distributed in America, efforts should be made to control the pest as soon as infestation is noted, otherwise *C. leucanthemum* may serve as an alternative host and thus render chrysanthemums more liable to attack each year. The control measures recommended are the destruction of infested plants and fumigation with hydrocyanic acid gas.

Four species of white grubs, *Lachnosterna fusca*, Froh., *L. fraterna*, Harr., *L. hirticula*, Knoch, and *L. tristis*, F., caused more or less injury to grass land, maize and potatoes. The systematic rotation of crops is advised in order to control these insects. The grasshoppers, *Melanoplus atlantis*, Riley, and *M. femoratus*, Burm., were destructive in some localities. Young individuals of the former species were observed in sandy places on the 11th May and had apparently hatched a day or two previously. Clover was readily attacked by the young hoppers. A few winged forms were observed on 17th June. Nymphs of *M. femoratus* appeared considerably later than those of *M. atlantis*. Natural enemies of these two species included a species of *Chalcis* and a

wasp, *Sphex ichneumonea*, L. Kansas bait was most efficient in destroying the grasshoppers, in some cases as many as 95 per cent. being killed. The following spray was also satisfactory:—3 lb. sodium arsenite, 1½ U.S. gals. molasses, 180 gals. water. It is advisable to apply the bait or spray while the insects are still young.

Insect pests of trees were abundant in the vicinity of New York City, especially *Scolytus* (*Eccoptogaster*) *quadrispinosus*, Say (hickory bark-beetle) and *Agrilus bilineatus*, Web. (lined chestnut borer). Investigations were made as to the effect of a well-known oil compound on the beetles and on the host tree. Six out of the ten trees tested died as the result of treatment. The trees were young and thin-barked and consequently may have been more liable to injury than more mature ones. In any case it is not advisable to use oils or oily compounds on the bark of living trees. *Malacosoma americana*, F., and *M. disstria*, Hb. (tent caterpillars) caused serious injury in certain districts. *Pissodes strobi*, Peck (white pine weevil) showed an increasing abundance on young trees. On small areas the most successful method of control was hand-picking. *Tortrix* (*Archips*) *cerasivorana*, Fitch (cherry worm) occurred during early summer on choke-cherry and in one case migrated from this host to the Lombardy poplar. *Dioryctria abietella*, Zinck., was found in the buds and young twigs of Austrian pine at Rochester. *Tibicen septemdecim*, L. (periodic cicada) appeared in certain localities, but without doing serious damage.

Among insect pests of fruit trees, *Rhagoletis pomonella*, Walsh (apple maggot) was found to have become abundant in the Hudson River and other districts. There was some evidence for believing that the application of an arsenical spray during the summer was effective in checking this pest. *Heterocordylus malinus*, Reut. (red bug) and *Lygidea mendax*, Reut. (lined red bug) injured apples in the Hudson Valley. Attack resulted in the discoloration of the leaves and fruit and in the hardening and irregularity in shape of the latter. The most suitable spray consisted of 1 pt. tobacco extract in 100 gals. water together with lime-sulphur wash, 1 to 25, with the addition of lead arsenate, applied just before the blossoms opened. *Aspidiotus perniciosus*, Comst. (San José scale) was less numerous in the Hudson Valley than in previous years. This fact however does not justify the abandonment of spraying in commercial orchards. *Agrilus sinuatus*, Oliv. (sinuate pear borer) is spreading into New York from New Jersey, and appeared in 1915 in several localities. Adult beetles emerge during May to feed on the foliage and can at this time be controlled by an arsenical spray. A deterrent wash consisting of from 60 to 80 lb. lime, 20 lb. copper sulphate and 100 gals. water is being tested. *Taeniothrips* (*Euthrips*) *pyri*, Dan. (pear thrips) caused very severe damage in the Hudson Valley. In one orchard spraying was carried out about 24th April with a mixture consisting of from 75 to 80 lb. lime, 100 gals. water and ¾ pt. Black Leaf 40. Large numbers of thrips were killed, but the results would have probably been even more satisfactory had the treatment been carried out earlier. *Psylla pyricola*, Forst. (pear psylla) continued to be injurious in the Hudson Valley, especially in those parts in which favourable hibernating places were present. *Conotrachelus crataegi*, Walsh, (quince curculio) occurred in some places. Evidence seems to show that this insect can be controlled by the application of a poisoned spray as soon as the

feeding punctures are observed, followed by a second one or two weeks later. *Galerucella cavicollis*, Lec. (cherry leaf beetle) was responsible for the partial defoliation of peach and cultivated cherry in some counties. Lead arsenate at the rate of 4 lb. to 50 gals. water, combined with Bordeaux mixture, was most efficient in controlling this insect.

Insects affecting grass crops were *Crambus luteolellus*, Clem. (grass webworm), *Philaenus lineatus*, L. (lined spittle insect), and *Aphrophora* (*P.*) *spumaria*, L. (European spittle insect). The first-named species was also very destructive to maize in one district. Susceptible crops should, if possible, be planted at some distance from grass land. Infested land should be ploughed in August or September to expose the half-grown larvae. If this is impracticable, spring ploughing should be delayed until the larvae have finished feeding. Frequent crop rotation should be practised.

A number of larvae resembling those of *Anthrenus* were recorded from New York, where they occurred in household articles and clothing, except woollen garments. The life-cycle was determined and found to occupy a year. The larvae were capable of living three or four years without food and were resistant to carbon bisulphide. The use of sodium fluoride was recommended against them.

Howard (L. O.). ***Lachnosterna* Larvae as a possible Food Supply.**— *Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 390–392.

Several methods of preparing *Lachnosterna* larvae for food are described. These are considered very palatable by those who have tasted them, and the author is of the opinion that these larvae will be shown to have a very definite food value.

Woglum (R. S.). **Reducing the Cost of Commercial Spraying.**— *Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 392–395, 1 fig.

This paper describes a method of reducing the cost of commercial spraying by 75 per cent., by the adoption of a system of underground pipes through which the spraying fluid is carried to all parts of the orchard. The experimental plot consisted of 10 acres and contained 1,125 trees. Piping ¾ inch in diameter was laid at a depth of 1 foot and provided with uprights for the attachment of hose at regular intervals. The spraying material used was water; this was carried by a one-inch pipe from a water main into a power sprayer having a 200-gallon tank, and thence was pumped directly into the pipe system. By means of the attachment of 150 feet of hose to each of the 24 hydrants, all trees in the orchard were easily reached. The total cost of the system was about 5d. per tree. The possibility of replacing water by an insecticide or fungicide such as nicotine and soap or lime-sulphur is suggested, as well as that of applying the system to the treatment of truck crops or orchards on steep hillsides. It is recommended that a pipe not less than one inch in diameter should be used, since the loss by friction in smaller pipes is too great. A large mixing tank automatically emptying into the spray tank would be necessary to produce a continuous supply of insecticide. Drainage outlets at the lowest levels should be provided for emptying the system after use.

McCOLLOCH (J. W.). **Additional Notes on the Use of Dust Sprays against the Corn-Ear Worm.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 395–398, 3 tables.

The experiments recorded in this paper were undertaken to determine (1) the number of applications of lead arsenate to control the corn-ear worm [*Chloridea obsoleta*, F.]; (2) the value of lime, flour, sulphur, etc., as carriers of lead arsenate; (3) the relative values of mixtures containing 75 per cent. and 50 per cent. of arsenate of lead. In the first series of experiments it was found that injury by *C. obsoleta* and by fungi decreased in proportion to an increase in the number of applications of a mixture of 75 per cent. lead arsenate and 25 per cent. sulphur. Plants dusted once showed about 5 per cent. insect injury while fungi were prevalent; those dusted eight times showed less than 1 per cent. insect injury, and fungi were absent. Controls were attacked to the extent of 8 per cent. of the grain by *C. obsoleta*, and at the same time were badly infested with fungi. The above mixture was found to be superior to that containing only 50 per cent. of lead arsenate. Sulphur was a better carrier than either lime or flour and showed some indications of value as a fungicide.

DOANE (R. W.), **A New Species of *Isosoma* attacking Wheat in Utah.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 398–401, 1 fig., 1 plate.

Isosoma grande and *I. vaginicolum*, sp. n., cause serious injury to wheat crops in the so-called dry farm regions in Salt Lake Valley. *I. vaginicolum* was first observed in May 1914, when adults appeared in a field of winter wheat. Eggs were deposited during the same month in the base of the leaf-sheath, just above one of the joints near the middle of the stem; from 3 to 20 eggs were placed in this position. The larvae occupied an oval cell in the sheath, and the latter became swollen and hardened so that the flow of sap was prevented. In consequence, the development of the flower-heads was partly or completely arrested. The total loss in the crop was estimated at from 50 to 75 per cent. More than one generation occurred during the year. The winter was passed in the larval stage in the stems, and pupation of the over-wintering generation took place in April and May. *I. grande* is not confined to the Salt Lake Valley, as is the preceding species, but occurs also in well irrigated districts. *I. tritici* was present in small numbers. The abundance of *Isosoma* in the Salt Lake Valley is greatly increased by the fact that wheat is sown in every alternate year, and during the intervening periods the land is allowed to lie fallow. Ploughing, if carried out at all during the fallow period, is performed with a disk plough, so that a large quantity of stubble is left on the ground. Frequently a self-sown crop is allowed to mature. The conditions are thus eminently suited to the rapid increase of *Isosoma* spp.

PENNINGTON (W. E.). **Notes on *Rhogas terminalis*, Cress. (Hymenoptera, Braconidae).**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 401–406, 1 fig., 1 plate, 1 table.

During an outbreak of *Cirphis* (*Heliophila*) *unipuncta*, Haw., in 1914, observations were made on the parasites of this insect, especially on

the Braconid, *Rhogas terminalis*, Cress. Adults of *R. terminalis* were collected at intervals between August and October by means of a light trap. In 1915, adults began to appear in the middle of April and numerous captures were made between May and August. In order to determine certain points in the life-history, adult parasites coming originally from parasitised larvae of *C. unipuncta* were confined with host larvae which had been reared in the laboratory and were thus known to be unparasitised. The age of the host larva was known in each case. Pairing on the part of the parasite took place immediately after emergence, and oviposition quickly followed. The combined duration of the egg and larval stages averaged 19·1 days and that of the pupa 16·7 days. Adult males lived on an average 16·5 days and adult females 32·5 days; the maximum duration of adult life was 35 days in the male and 75 days in the female. Fertilised females gave rise to offspring of both sexes; unfertilised females were able to reproduce pathenogenetically, but the offspring were males in all cases. Oviposition took place only in host larvae in the second and third instar. Hibernation was found to occur in the pupal stage. In the latitude of Hagerstown probably at least four complete generations of *R. terminalis* occur each year.

PETTIT (M.). **Investigation and Instruction in Beekeeping.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 406–411.

In his address delivered before the American Association of Economic Entomologists, the author enumerates the various problems which still require extensive investigation. These include the wintering of bees, prevention of swarming, preparation of honey for sale, influence of weather conditions on the working of bees, comb building, bee diseases, etc. A brief outline is given of the courses of instruction in agriculture offered at the Ontario Agricultural College and of the extension work carried on in that Province.

SLADEN (F. W. L.). **Bee Work at the Canadian Government Experimental Farms.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 411–413.

Agricultural investigations are carried out at the Central Farm, Ottawa, and at thirteen Branch Experimental Farms. In all cases it has been found that bee-keeping can be profitably carried out, although in Nova Scotia the wintering problem is a difficult one, on account of the long winter with its sudden changes in temperature, and by reason of the unwholesome stores gathered by the bees. The sources, quantity, quality and period of production of honey, are the main objects of investigation at the present time. Lucerne has been proved to be a source of honey in south Alberta.

PHILLIPS (E. F.). **The Purpose of College Beekeeping.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 413–417.

The author emphasises the need for more extended scientific investigations on the subject of bee-keeping and for the increased production of honey for commercial purposes. The introduction of

agricultural teaching into the curriculum of agricultural colleges is of comparatively recent date. The courses are thus not yet arranged in the best possible manner and will require considerable readjustment if they are to offer a thoroughly practical course of training. It is assumed that a year's course, supplemented by work during the summer in a commercial apiary, should be sufficient to acquire a practical knowledge of bee-keeping. Considerable attention should be devoted to the wintering problem and to the manipulation of bees.

CORY (E. N.). **The Columbine Leaf-Miner.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 419–424, 2 figs., 1 plate.

Phytomyza aquilegiae, Hardy, was first observed in the larval stage in Maryland on 11th May 1914. Mines then occurred only in the lower leaves, but later spread throughout the entire foliage. Hibernation of this species takes place in the pupal stage. Adults appear at the end of April and the beginning of May. Females feed before pairing on juices exuded from punctures made in the leaves by their ovipositors. Eggs are imbedded to a greater or less degree in the tissue of the under side of the leaf. The average duration of the egg-stage of the first generation is 5½ days, that of later generations, two days. The length of the larval period is more dependent on the food-supply than on the temperature; the average duration for all generations is 10½ days, but where the food-supply is scarce, this may be reduced to six days. Pupation takes place outside the leaf, the pupae being attached to the under side of the latter. The duration of this stage in the first two generations averages 14 days; the third generation may require 19 days, or a period of aestivation may intervene, lasting from the beginning of June until the second week in September. A fourth generation appears in the middle of September; the pupae of this brood hibernate on or below the surface of the soil at the base of the host plant. Broods other than the first are controlled to a considerable degree by parasites, of which 13 species have been reared. These include:—*Clostocerus tricinctus*, Ashm.; *C. utahensis*, Gahan; *Sympiesis agromyzae*, Gahan; *Diaulinus pulchripes*, Crawf.; *D. begini*, Ashm.; *Derostenus varipes*, Crawf.; *D. pictipes*, Crawf.; *Zagrammosoma multilineatum*, Ashm.; *Pleurotropis* sp.; *Aphaereta* sp.; *Chrysocharis* sp.; *Derostenus* sp. n., and a Mymarid.

Control measures include the removal and destruction of infested leaves during May and the turning over of the soil at the base of the plants before 1st April in order to expose the pupae.

PIERCE (W. D.). **Notes on the Habits of a Dangerous Genus of Weevils.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 424–431, 3 figs.

Four species of weevils belonging to the genus *Polydrusus* are either natives of, or have been long established in America, and two other species, *P.* (*Eustolus*) *impressifrons*, Gyl., and *P.* (*Thomsoneonymus*) *sericeus*, Schall., have been imported recently from Europe. *P. delicatulus*, Horn, and *P. peninsularis*, Horn, occur in lower California; *P. corsicus*, Tournier, feeds in the adult stage on the buds of *Quercus*

spp., etc.; and *P. viridicollis*, Baudi, injures the foliage and epidermis of the young growth of *Fraxinus*, *Cytisus*, *Acer* and *Quercus cerris*. *P. impressifrons* (poplar root weevil) is found in Europe on *Populus* spp., *Salix*, *Alnus*, etc. In New York and Connecticut it has caused considerable damage to *Salix*, *Populus*, birch, apple and pear. Adults appear during the latter part of May and oviposit immediately under loose bark, among loose bud-scales or in wounds. The eggs are laid in masses of from 20 to 80, and the larvae, upon hatching, drop to the ground and feed on the roots of the host. The adults may be controlled by the application of arsenicals. *P. sericeus* occurs in Europe in the adult stage on the buds of pear, plum, beech, hawthorn, apple, etc. In America, it has been recorded from Indiana.

Notes are given on the feeding habits of 35 additional species of *Polydrusus*, occurring mainly in Europe.

JONES (T. H.). **Notes on *Anasa andresii*, Guér., an Enemy of Cucurbits.**—*Jl. Econ. Entom.*, *Concord*, ix, no. 4, August 1916, pp. 431–434.

Anasa andresii, Guér., has been recorded from Cuba, Mexico, Guatemala, Costa Rica, Panama, Colombia, and in the United States from Florida, Texas, and New Mexico. The notes on the life-history given in this paper were obtained during 1915 from a study of this species on squashes in Louisiana. The first adults were observed in the field on 26th May. Eggs were found soon afterwards, usually on the under surface of the leaves, occasionally on the upper surface or on other aerial portions of the plant, or on surrounding vegetation. They are placed singly or in masses containing from 2 to 50 eggs. The incubation period varies from 7 to 11 days between June and September inclusive. Nymphs and adults feed on the juices of the leaves, causing them to wilt and die. The duration of the nymphal stage is about 18 days.

HYSLOP (J. A.). ***Triphleps insidiosus* as the Probable Transmittor of Corn-Ear Rot (*Diplodia* sp., *Fusarium* sp.).**—*Jl. Econ. Entom.*, *Concord*, ix, no. 4, August 1916, pp. 435–438.

Previous records of the Anthocorid bug, *Triphleps insidiosus*, have shown that it is both beneficial, in that it attacks various stages of *Blissus leucoptera*, *Phylloxera*, *Chloridea* (*Heliothis*) *obsoleta*, *Contarinia* (*Diplosis*) *sorghicola*, etc., and injurious, in that it causes injury to chrysanthemums, squash vines and red clover. Corn-ear rot, due to *Diplodia* sp. and *Fusarium* sp., was observed in the maize crops in Maine in 1912. The disease appeared when the seeds were in the milk stage as a yellowish discoloration immediately below the point of attachment of the silk. From this point the discoloration spread throughout the seed, until finally the seed-coat ruptured. Experiments on the transmission of the disease showed that the fungus could only enter through a puncture in the seed coat. Large numbers of *T. insidiosus* were found to be present in infested fields in the silk, under the husks and among the dead leaves, etc., at the base of the plants. It was therefore considered probable that this insect was connected with the

transmission of the disease. This supposition was supported by previous records of the habits of *T. insidiosus* in feeding on the eggs of *Chloridea obsoleta* (corn-ear worm). *T. insidiosus* hibernates during the winter among leaves, etc., on the ground, and during this time becomes infected with the disease. While searching for the eggs of *C. obsoleta* in the silks, the fungus is introduced into the oviposition punctures of the latter insect. Thence the fungus is assumed to spread through the silk to the apex of the seed. Should this supposition be correct, the injurious effects of *T. insidiosus* will be greatly accentuated. Remedial measures against *Diplodia* and *Fusarium* should be carried out very thoroughly. Maize should not be planted in fields which have borne a diseased crop, and it is recommended that leaves and stubble in infected fields should be burned over. Ploughing should be carried out as close to the surrounding fences as possible in order to destroy potential hibernating places.

PARKER (R. R.). **Sarcophagidae of New England: Genus *Sarcophaga*.**—*Jl. Econ. Entom., Concord*, ix, no. 4, August 1916, pp. 438–441, 1 fig.

A description is given of *Sarcophaga aldrichi*, sp. n., reared from pupae of *Lymantria* (*Porthetria*) *dispar*, L., and larvae of *Malacosoma disstria*, Hb., in Massachusetts and Ontario respectively.

WEISS (H. B.). **The Insect Fauna of New Jersey Greenhouses exclusive of the Coccidae.**—*Jl. New York Entom., Soc., Lancaster, Pa.*, xxiv, no. 2, June 1916, pp. 144–150. [Received 1st September 1916.]

This list contains the names of 49 species of insects present in greenhouses, of which 23 are unable to live in the open and are probably of tropical or sub-tropical origin. The author recommends that more attention be paid to greenhouse insects, in the control of which temperature and moisture are important factors.

SCHOLL (E. E.). **Garden Insects and their Control.**—*Texas Dept. Agric., Austin*, Bull. no. 48, March–April 1916, pp. 154–171. [Received 2nd September 1916.]

Garden insects can be controlled by crop rotation, deep autumn and winter ploughing, the use of trap crops and by spraying. Chewing or biting forms can be destroyed by dusting or spraying with arsenicals, and sucking forms by fumigation with carbon bisulphide or hydrocyanic acid or by a contact spray, such as kerosene emulsion, carbolic acid solutions, lime-sulphur washes, etc. Arsenicals may be applied (1) in the form of powder, either alone or mixed with lime, flour or road dust; (2) suspended in water; (3) mixed with a palatable substance in the form of a bait. Liquid arsenical sprays for delicate plants may be prepared from 1 lb. Paris green, 3 to 5 lb. stone lime and 100 to 200 U.S. gals. water. London purple may be substituted for Paris green, in which case the quantity of stone lime is slightly increased. Lead arsenate may be used at the rate of 2 lb. in 50 gals. water for

delicate plants and 4 or 5 lb. in the same quantity of water for hardy plants. Arsenite of soda has the advantages of being cheap and of remaining in suspension for a long period. The formula for a stock solution is 1 lb. white arsenic, 2 lb. washing soda, 2 gals. water. The stock solution is made up to 50 gals. before use, and for delicate plants from 2 to 3 lb. slaked lime are added. Calcium arsenite spray is prepared according to the formula, 1 lb. white arsenic, 2 lb. stone lime, and 2 gals. water; a quart of the stock solution is diluted to 75 gals. for use on delicate foliage.

Formulae are given for the preparation of poisoned baits, lime-sulphur wash and other contact sprays. For destroying or acting as a deterrent against underground insects, tobacco dust is recommended. The surface soil is removed from around the base of the plant, tobacco dust is scattered in the depression and water sprayed over it. Soft-bodied insects have been successfully controlled by a contact spray consisting of 1 lb. hard soap, 1 pt. crude carbolic acid, and 30 gals. water. A preparation consisting of 2 gals. whale oil soap, 3 gals. red engine oil (25° Bé.), and 1 gal. water, diluted with 50 gals. water before use, is recommended for treatment of Aphids, red spider, and cabbage caterpillars. A long list of garden vegetables with the common and scientific names of their insect pests is appended to this paper.

MASON (C.). **Report of the Government Entomologist.**—*Ann. Rept. Dept. Agric. Nyasaland for the Year ended 31st March 1916, Zomba*, 30th June 1916, pp. 19–22. [Received 4th September 1916.]

Cotton was generally attacked by boll-worms and leaf-hoppers. A flea-beetle caused severe damage in one district and the stem-boring larva of a Cerambycid in another. Pests of tobacco were the same as those in previous years; *Phthorimaea* was abundant, *Chloridea* and *Prodenia* occurred on young plants, while shipments of tobacco were damaged by *Lasioderma*. Maize was injured to a certain extent by *Prodenia*, *Phytometra* (*Plusia*) *chalcites*, Esp., and *Cirphis loreyi*, Dup. The absence of the borer, *Busseola fusca*, Hmp., was marked. Eight species of SATURNIIDAE were reared, but none gave silk of a commercial value. *Anaphe ambrizia*, Butl., was taken at night from December to March. *A. panda*, Boisd., was abundant at Zomba on *Bridelia micrantha* and is under investigation. The larvae were heavily parasitised by two or possibly three species of Tachinids. Teff grass was severely injured during April by the larvae of the Noctuid, *Laphygma exempta*, Wlk. This species was parasitised by the Bombyliid, *Villa flavescens*, Bez., the Ichneumon, *Paniscus testaceus*, Grav., var. *opaculus*, Thoms., and to a lesser degree by another Ichneumon and a Chalcid. The migration of a swarm of caterpillars belonging to 15 different species from an area of cleared bush to tobacco, maize, etc. was observed in one district. The migration was due to the destruction of the native food-plants.

Several species of fruit-flies were recorded during the year. *Ceratitis rosae*, Karsch (mango fruit-fly) required about 24 days to complete the larval, and from 9 to 11 days to complete the pupal stage. *Ceratitis* sp. was reared from peach and guavas. *Dacus bivittatus*, Big. (pumpkin

fly) caused considerable damage to pumpkins, marrows, etc. The duration of the stages was as follows:—Egg, from 3 to 4 days; larva, from 18 to 29 days; pupa, from 12 to 24 days. The larvae were attacked by a predaceous ant and by a Hymenopteron, parasitic on the pupae. *D. brevistylus*, Bez., was found associated with *D. bivittatus*, but in smaller numbers. The duration of the stages was as follows: larva, 22 days; pupa, from 9 to 11 days. Adults of both species were found on the flowers of *Euphorbia* sp. A species of Stratyomyiid was reared from marrows infested with *D. bivittatus* and was probably predaceous on the latter. An arsenical spray recommended for treating fruit trees is prepared according to the formula:—4 oz. lead arsenate, 3 lb. treacle sugar or 5 pts. unrefined treacle, and from 5 to 8 gals. water. Marrows should be protected by cheese-cloth or mosquito-netting placed at a short distance from the fruit.

OSBORN (H.). **Studies of Life Histories of Leafhoppers of Maine.**—*Maine Agric. Expt. Sta., Orono*, Bull. no. 248, March 1916, pp. 53–80 8 figs., 5 plates. [Received 5th September 1916.]

Leafhoppers are serious pests of grasses and cereal crops in Maine, in that they cause the stunting of affected plants and a reduction in the proportion of proteid and fatty constituents. *Cicadula sexnotata*, Fall., occurs in Europe and throughout North America. The food-plants are numerous, but in Maine the most serious damage is caused to meadow grasses and oats. Adults are numerous in oat-fields at the end of June and the beginning of July, and deposit eggs in the tissue of the leaf-sheath and leaf-base. Adults in captivity oviposited on oats on the 10th July. The number of eggs laid in any one leaf-sheath or leaf-base is considerable, 37 having been counted in one inch. The average duration of the egg-stage is about seven days. The nymphs upon hatching emerge from the leaf tissue and feed by puncturing the surface. Injury results in the production of whitish areas which gradually become brown and finally black. A poisonous substance is probably secreted while feeding, since there is a tendency for affected leaves to wither and change colour at the tips. Adults appear about 20 days after hatching and are probably ready to begin egg-laying in a week or 10 days. A generation of *C. sexnotata* probably develops in grass land before 1st July; adults of the second generation migrate about the middle of August from the oat crop to self-sown oats or other cereals or to grass land. A third generation develops between this date and the beginning of October, and may deposit eggs among the bases of grass plants and pass the winter in this stage. Both nymphs and adults are capable of very active movements; they drop readily when disturbed and the adults can fly for considerable distances. The species is thus easily distributed to new fields, while control by crop rotation is probably rendered less effective. Adults on young oats can be captured in considerable numbers by the use of a hopper-dozer and the destruction by ploughing of stubble and self-sown crops reduces the numbers of the autumn generation.

Acocephalus albifrons, L. (timothy crown leafhopper), is apparently restricted to timothy grass and is characterised by the subterranean habit during the nymphal and part of the adult stage. A single generation occurs annually. Eggs deposited in late summer and

autumn probably hatch in May or early June and reach the adult stage in July. The nymphs live beneath the surface litter or in crevices round the base of the host plant. The control of this species is best effected by crop rotation and by ploughing in late autumn and early spring. Spiders are predaceous on the underground stages. *A. striatus*, L., occurs on grass land in which there is an abundance of timothy grass which is probably the favourite host plant. The winter is almost certainly passed in the egg stage. Hatching takes place during June, and the nymphs are usually found either on the ground or on the host plant near its base. Young nymphs probably attack the base of the stems or the crowns, while in later stages they injure the stem and leaves. Adults are more active than the nymphs and can be taken readily by sweeping. The first adults were obtained at Orono on 1st July; both sexes were abundant by the end of the month. Crop rotation and the burning over of infested land in autumn are recommended. *Chlorotettix unicolor* is found on rank grasses in the southern parts of the State. Nymphs are abundant in July and adults during July and August. There is probably one generation annually. *Idiocerus provancheri* occurs in bogs, and nymphs and adults have been collected in July. *Draeculacephala angulifera*, Walk., has been found in the nymphal stage during the summer; there is probably one generation each year. Two specimens, doubtfully referred to *Phlepsius apertus*, van D., were taken on timothy grass. *Balclutha punctata*, Thunb., is widely distributed, occurring especially on Canadian blue grass, upon which all stages have been found during August.

EWING (H. E.). **Eighty-seven Generations in a Parthenogenetic Pure Line of *Aphis avenae*, Fab.**—*Biol. Bull., Marine Biol. Laboratory, Woods Hole, Mass.*, xxxi, no. 2, August 1916, pp. 53–112, 19 figs., 12 tables.

In these experiments, the effect of continued parthenogenetic reproduction on virility and metabolism and that of temperature on growth, size, reproduction and dimorphism was studied. In addition to results bearing especially on these points, other general conclusions were reached. The optimum temperature for the production of wingless agamic forms is about 65° F.; the percentage of winged forms increases above and below this temperature. A constant temperature of 90° F. completely prevents development. Continued parthenogenetic reproduction shortened the growth period, but did not affect the size or fecundity of the strain used. Paedogenesis occasionally occurs among winged and wingless nymphs.

SOUTH (F. W.). **Summary of the Locust Work for the 1st Quarter 1916.**—*Agric. Bull. Fed. Malay States, Singapore*, iv, no. 9, June 1916, pp. 291–297, 1 table. [Received 7th September 1916.]

Three locust swarms were observed at the beginning of the year in Selangor, but the breeding of these was either delayed or failed completely, since no young forms were found as late as the end of April. In the Tampin District of Negri Sembilan young hoppers appeared in large numbers at the end of March. This state of affairs is attributed to defective scouting work in February and the beginning of March and to the entrance of flying swarms from Johore and Malacca.

Scouting in Malacca in February showed the presence of a small number of swarms only, but contrary to expectation, young hoppers were abundant in March. Their prevalence may have been due to the entrance of swarms from Johore, but possibly in both Malacca and the Tampin District a proportion of the hoppers may have hatched from eggs which had been lying dormant for six months or longer. In Johore a few swarms were destroyed at Batu Anam during January.

CHAMPION (G. C.). **On Some Weevils Attacking Orchids.**—*Entomologist's Mthly. Mag., London*, lii, no. 628, September 1916, pp. 200–202.

Descriptions are given of *Cholus cattleyae*, sp. n., breeding in bulbs of *Cattleya gigas*, and *Diorymellus laevimargo*, sp. n., attacking the roots of orchids, and feeding on the leaves and flowers of *Cattleya* and the flowers of *Dendrobium*. Both species occur in tropical America. Other injurious species recorded are *Baridius orchivora*, Blackb., and *Acythopeus aterrimus*, Waterh.

GIRAULT (A. A.). **A New Genus of Scelionidae from the West Indies.**—*Entomologist, London*, xlix, no. 640, September 1916, pp. 198–199.

A description is given of *Phanuropsis semiflaviventrus*, gen. et sp. n., reared from Hemipterous eggs from Trinidad.

GIRAULT (A. A.). **A New Genus of Ophioneurine Trichogrammatidae from Java.**—*Entomologist, London*, xlix, no. 640, September 1916, pp. 199–200.

Lathromeromyia perminuta, gen. et sp. n., reared from the eggs of *Cicada* sp. ? on leaves of sugar-cane from Java, is described.

GIRAULT (A. A.). **Descriptions of and Observations on some Chalcidoid Hymenoptera—II.**—*Canadian Entomologist, London, Ont.*, xlviii, no. 8, August 1916, pp. 263–268.

The following species are recorded:—*Apterolaelaps nigriscutum*, gen. et sp. n., from Virginia; *Diaulinus intermedius*, sp. n., reared from *Phytomyza chrysanthemi*; *Pseudiglyphomyia coptodiscae*, sp. n., reared from *Coptodisca splendoriferella*; *Asaphes americana*, Gir., reared from the clover aphis; *Trichogrammatomyia tortricis*, gen. et sp. n., from the eggs of *Tortrix cerasivorana*. A key to the identification of the North American species of the genus *Euplectrus*, Westw., is given.

AVERIN (V. G.). **Возможность массоваго нашествія лугового мотылька.** [The possibility of an outbreak of *Phlyctaenodes sticticalis*.]—**«Южно-Русская Сельско-Хозяйственная Газета.»** [*South Russian Agricultural Gazette*], *Charkov*, xviii, no. 23, 6th July 1916, p. 14.

This letter calls attention to the possibility of an outbreak of caterpillars of *Phlyctaenodes sticticalis*. Large numbers of the moths were observed about the middle of June, the cold spring having delayed

their emergence from the pupae for about three weeks. The immediate destruction of weeds, particularly *Atriplex*, *Amaranthus* and *Convolvulus* is urged, as oviposition is effected on these and they provide the first food for the caterpillars. An outbreak of caterpillars of *Euxoa segetum* is also to be expected, the chief remedy against which consists in the destruction of weeds on the fallow land kept for winter sowing.

Novak (A.). **Хрущъ, какъ вредитель, борьба съ нимъ и способы его использованія.** [Cockchafers as pests, their control and methods of utilisation.] — **«Южное Хозяйство.»** [*Southern Husbandry*], *Ekaterinoslav*, v, no. 11, 28 June 1916, pp. 233–240.

The cockchafers on the wing in May belong to two species, *Melolontha melolontha* (*vulgaris*), found in South-Western Russia, and *M. hippocastani*, spread all over Russia, except the Crimea and Siberia. Two other species are on the wing in June: *Polyphylla fullo*, found only to the south of the line Kovno-Samara, and *Amphimallus* (*Rhizotrogus*) *solstitialis*, found everywhere. These insects attack both deciduous and coniferous trees, particularly birch, oak, beech, maple, lime, poplar, nut, rose, vine, apple, plum and, among coniferous trees, pines, spruce, silver-fir and larch. The remedies against these pests are divided into preventive and destructive. The former include (1) the injection into the soil of odoriferous substances, such as kerosene, naphtha, crude naphthaline, etc., to drive away the larvae and also to prevent oviposition; (2) the formation of a layer over the soil to prevent oviposition, for which purpose the ground is covered with half an inch of hay or straw and then heavily watered, the watering being repeated not less than three times during the time the insects are on the wing. The destructive remedies include insecticides against the adults, such as Paris green and arsenic; the poisoning of the larvae by injecting carbon bisulphide, Paris green, arsenic, barium chloride, etc., into the soil; and the collection and destruction of the larvae and adults. The great numbers of beetles which are collected by the last means can be utilised in various ways. For manuring purposes, they are placed in a pit, preferably in chalk or hard soil, and treated with freshly slaked lime until a semi-liquid substance is obtained; sifted earth is then added and the whole stirred with shovels and again treated with lime; after being left for about three days, a manure rich in nitrogen will thus be obtained. As food for poultry, the beetles may be mixed with an equal volume of bran. To obtain oil from them, they are crushed in barrels or tubs until a completely homogeneous dough is obtained, which, after the addition of water, is left for three or four months. The oil rises gradually to the surface and is removed. It can be used for ordinary lamps, giving a good flame without odour or smoke; about 20 litres of oil are obtained from 100 litres of beetles. To extract the fat, the beetles are killed with chloroform or formalin and then placed in a glazed earthenware vessel into which a narrow pipe is inserted, reaching to the bottom of the pot; the vessel is covered with a lid, having a hole for the passage of the pipe, and when this is heated on a slow fire, the fat will gradually flow out from the pipe. This becomes thick after cooling and may be used both for lubricating and illuminating purposes.

UVAROV (B. P.) & GLAZUNOV (V. A.). **Обзоръ вредителей.** [A review of pests.]—**Отчетъ о дѣятельности Ставропольскаго Энтомологическаго Бюро за 1914 годъ.** [Report on the work of the Entomological Bureau of Stavropol for 1914], published by the Department of Agriculture of the Ministry of Agriculture, *Petrograd*, 1916, pp. 13–54, 7 figs.

This is a list of pests in the Government of Stavropol during the year under report, omitting many of those in previous reports [see this *Review*, Ser. A, i, p. 459, and iii, p. 44], but containing some additional ones. Owing to the absence of N. V. Kurdjumov at the front, a great number of Hymenopterous parasites of pests could not be identified, while Dipterous parasites could not be sent to France to Dr. Villeneuve.

The pests recorded include:—*Thrips linarius*, Uzel, which was observed on flax, both in its larval and adult stages, its attacks delaying and distorting the growth of the plant.

Rhynchota: *Aelia acuminata*, L., *A. sibirica*, Reut., and *A. rostrata*, Boh., were present in large numbers on wheat and wild grasses; *Palomena prasina*, L., occurred occasionally on gooseberries, and *Carpocoris lunulatus*, Goeze, on flax. *Eurydema ornatum*, L., in the eastern part of the government, was present in some number on cabbages and radishes in market-gardens, and on rape and mustard in the fields; only two generations occur during the summer, the first one becoming mature in June and the second reaching the imago stage prior to hibernation. The chief injury to cabbage is done by the hibernating adult and by the larva of the first generation; the second generation of the larvae feeds mainly on the outer leaves without doing appreciable damage; the eggs of the second generation were infested by a parasite, probably *Trissolcus simoni*, Mayr. *E. festivum*, L., is occasionally found together with the foregoing species, and in one locality a number of *E. festivum* var. *chloroticum*, Horv., were caught on winter crops. The following occurred on gooseberries:—*Syromastis marginatus*, L., *Rhyparochromus chiragra*, F., *Calyptonotus rolandri*, L., *Drymus sylvaticus*, F., *Piesma maculata*, L., and *Monanthia echii*, Schrk. *Montandoniella dacica*, Put., was found singly on fruit trees, but as, according to A. N. Kiritchenko, this is a predaceous species, it must be excluded from the list of pests for 1913 [see this *Review*, Ser. A, iii, p. 44]. *Adelphocoris seticornis*, L., was found amongst great numbers of *A. lineolatus*, together with *A. vandalicus*, Rossi, and *A. ticinensis*, Mey. *Brachycolus scriptus*, F., also occurred in company with these. *Lygus pratensis*, L., and single examples of *L. kalmi*, L., were found on gooseberries, *L. rubricatus*, Fall., (*rubicundus*, Mey.) on fruit trees under trap-belts, and *Poeciloscytus cognatus*, Fieb., in great numbers on a great variety of plants, including mustard, rape, lucerne and sunflower. *Typhlocyba rosae*, F., was present from the end of March to the end of August, doing considerable injury to roses, apples, plums and gooseberries.

Aphids included:—*Eriosoma* (*Schizoneura*) *lanigerum*, Haus.; *Chaitophorus populi*, L., on *Populus alba*; *Macrosiphum granarium*, Kirby, (*cereale*, Kalt.) on barley and wheat; *Acyrthosiphon pisi*, Kalt., on lucerne; *Hyalopterus arundinis*, F., on apricots and plums; *Rhopalosiphum ribis*, Buckt., both stem-mothers and young individuals of the second generation, on gooseberries; *Toxoptera graminum*, Rond., on the leaves of oats, where colonies of *M. granarium* occurred on the

ears and those of *Brachycolus noxius* on the rolled leaves; *Aphis prunina*, Walk., on plums; *A. vitis*, Scop., on vine; *A. craccivora*, Koch., on lentils; *A. persicae*, B. de F., on apricots and almonds; *A. obnoxia*, Mordw., sp. n., on leaves of barley (in the previous report this species was recorded as *Aphis* sp. n., on sorghum); *A. crataegi*, Kalt., on apple; *A.* sp. n., on millet; *A. brassicae*, L., on cabbage and mustard; *A. crataegi*, Buckt. (*gossypii*, Wass.) very injurious to bachza plants in one locality; *A. rumicis*, L., on poppy, and *A. pomi*, de G., on apples. *Phenacoccus aceris*, Sign., was frequently found in cracks in the bark of old apple trees, more rarely of pear and apricot trees, but not on vines.

Lepidoptera: *Papilio podalirius*, L., occurred on plums; *Pieris daplidice*, L., on mustard, many parasites being obtained from the pupae; and *Deilephila lineata*, F., var. *livornica*, Esp., on vine. The caterpillars of *Lymantria dispar*, L., did considerable damage to orchards in various localities in the valley of the Kuma, where they have greatly increased since 1913. From 295 pupae collected on 17th July there were reared 42 Dipterous larvae and six Chalcid parasites. *Gastropacha quercifolia*, L., was recorded on pear trees, *Acronycta tridens*, Schiff., on apricots, while *Barathra* (*Mamestra*) *brassicae*, L., did considerable damage to cabbages in May, June and July. *Chloridea* (*Heliothis*) *dipsacea*, L., is a serious pest of flax. The life-history of this species have been studied on the spot by A. D. Shamrai, whose observations show conclusively that two generations of the adults occur, thus differing from the results obtained by Krassilstchik. It is probable however, that in some parts of North Caucasia, *C. dipsacea* has only one generation and that in some years the caterpillars of the late adults do not pupate at once. The caterpillars of *Cucullia santonici*, Hb., attacked the leaves of sunflower; this species appears to be recorded as a pest for the first time. *Eubolia arenacearia*, Hb., injured lucerne and *Sarrothripus revayana*, Sc., attacked the leading shoots of young seedling poplars. *Homoeosoma nebulella*, Hb., was present in great numbers; according to N. N. Filipiev, the caterpillars which were found on sunflower belong, not to this species, but to *H. nimbella*, Z., not previously recorded as a pest of this plant. *Phlyctaenodes sticticalis*, L., was observed in great numbers in the caterpillar stage, but these were evidently destroyed by reploughing, as no outbreak of the adults occurred later. *Tortrix* (*Cacoecia*) *podana*, Sc., occurred on black currants, gooseberries, apples and elder; *Tortrix* (*Pandemis*) *ribeana*, Hb., on apple and maple; *T. heparana*, Schiff., on pears, blackcurrants, gooseberries, apples and raspberries; *Phalonia* (*Conchylis*) *epilinana*, Z., on flax. *Tortrix viridana*, L., seriously injured oaks; other species being *Hyponomeuta malinellus*, Z., *H. padellus*, L., and *H. rorellus*, Hb., on willows; *Plutella maculipennis*, Curt., on cabbages, rape and to a less degree mustard; and *Gelechia rhombella*, Schiff., and *Coleophora nigricella*, Stph., were very common on apple trees.

Coleopterous pests included:—*Epicauta erythrocephala*, Pall., seriously injuring fodder beet; *Omophlus* sp., in large numbers in May on flax and mustard; *Podonta* sp., on wheat and rape; *Lema melanopa*, L., on summer-sown wheat and barley; and *Colaphus hoefti*, Men., on mustard. This species, and not *C. sophiae*, Schall. [see this Review, Ser. A, i, p. 537 and ii, p. 355], probably also occurs in the

neighbouring government of Astrachan, as the latter species is replaced to the east of the river Don by *C. hoefti*. *Melasoma* (*Lina*) *populi*, L. occurred on poplars, and *Otiorrhynchus aurosparsus*, Germ., was found in great numbers in orchards. The nature of the injury done by this weevil is similar to that caused by *Sciaphobus squalidus*. No males have been found, and this species is believed to multiply by parthenogenesis. Other weevils include:—*Otiorrhynchus ligustici*, L., doing considerable damage to lucerne; *Phyllobius oblongus*, L., in great numbers in orchards, especially on plum trees; *Phyllobius pyri*, L., and *Eudipnus micans*, F., on elm-trees; *Sciaphobus squalidus*, Gyll., present in large numbers and doing considerable damage, particularly to pear-trees; *Psalidium maxillosum*, F., on mustard; *Bothynoderes punctiventris*, Germ., and *Conorrhynchus nigrivittis*, Pall., var. *kindermanni*, Fst. Some observations by A. D. Shamrai on *Lixus ascanii* on mustard are at variance with some statements of N. Sacharov [see this *Review*, Ser. A, i, p. 536, and ii, p. 355] with regard to the number of generations and the mode in which the stems are hollowed by the larvae of this species. According to Shamrai, there are two generations, or at least the hatching of the second generation takes place before the winter, these weevils hibernating as adults and not as larvae. *Ceuthorrhynchus macula-alba*, Hbst., did considerable damage to poppies in some localities, and *Baris scolopacea*, Germ., was present in large numbers on fodder beet. An enormous outbreak of *Anthonomus pomorum*, L., occurred in the year under report, great damage being done to apple trees, while pear trees suffered less. *Byctiscus betulae*, L. (*Rhynchites betuleti*, F.) on vines; *R. auratus*, Scop., on cherries; *R. bacchus*, L., on stone-fruits; *R. giganteus*, Kryn., *R. pauxillus*, Germ., *R. aequatus*, L., *Anisoplia austriaca*, Hbst. var. *major*, Rttr., *A. zwickii*, Fisch., *A. cyathigera*, Scop., and *A. segetum*, Hbst., *Epicometis* (*Tropinota*) *hirta*, Poda, and *Oxythyrea funesta* (*stictica*) on raspberries; *Blitopertha lineata*, on haricot beans and wheat; and *Pentodon idiota*, Hbst., were also present.

Dipterous pests included:—*Oscinella frit*, L., var. *pusilla*, Meig., on oats, and *Contarinia tritici*, Kirby.

Hymenoptera: *Xylocopa violacea*, F., was reported from one locality to be damaging beams in houses. Adults of *Eurytoma amygdali*, End., were reared from plum stones. *Eriocampoides limacina*, L. (*Eriocampa adumbrata*, Klug) was found in the larval stage on cherries, *Hoplocampa fulvicornis*, Kl., on plums, and *Athalia colibri*, Christ (*spinarum*, F.), on cabbages and mustard. A large outbreak of *Cephus pygmaeus*, L., and *Trachelus tabidus*, L., occurred in the year under report. As this was accompanied by similarly large numbers of the parasite, *Collyria calcitrator*, Grav., it was not probable that they would reappear again in such numbers in 1915.

Vinokurov (G. M.). **Изъ біологическихъ наблюденій надъ перелетной саранчей.** [Biological observations on *Locusta migratoria*.]—**Отчетъ о дѣятельности Ставропольскаго Бюро за 1914 годъ.** [Report on the work of the Stavropol Entomological Bureau for 1914], published by the Department of Agriculture, Ministry of Agriculture, *Petrograd*, 1916, pp. 84–101, 2 figs.

These observations were made in 1913 and 1914 during the campaign against *Locusta* (*Pachytylus*) *migratoria* in the government of Stavropol.

The chief and permanent breeding place of this locust is situated in the valley of the river Kuma, in reed-beds (*Phragmites communis*). In 1913, after the destruction of the local locusts, a new swarm arrived from the neighbouring province of Terek and infested some 11,000 acres of adjoining meadows with its eggs; the locusts hatching from these eggs in 1914 were, however, mostly destroyed. The process of oviposition is described in detail. The more elevated spots amongst the reeds are mainly selected for this purpose; these areas are usually overgrown with plants, such as *Bromus inermis*, *Triticum repens* and *Carex*. The character of the soil is also of importance, as the locusts avoid sandy soils or those containing salt, preferring light loam containing much humus and roots of reeds or grasses. Some egg-clusters are of a small size and contain smaller eggs, and the majority of these become infected with a mould. This is also sometimes the case with normal egg-clusters. An unidentified disease was observed among the adults, destroying some 10–15 per cent. of them. The commonest parasite is a red mite, which was usually found attached to the veins of the wings, 200 being frequently found on a single individual. They also occur on the young stages on various parts of the body. More important enemies are the larvae of several species of viviparous flies, which attack all stages except the first, on which they have not yet been found. If numerous, they bring about the gradual death of the host, but as the percentage of locusts infested is not great, varying from 2 to 25 per cent., they are not of great practical importance. In damp localities, a small percentage are also attacked by intestinal worms, a species of *Mermis*. The chief enemies of the egg-clusters are:—mites, the larvae of *Epicauta erythocephala* and Dipterous larvae. The mites which feed on the eggs are about three times the size of those which attack the larvae and adults. The egg-clusters are also attacked by larvae of Bombyliid flies of the genus *Systoechus*. Notwithstanding their numbers, the percentage of egg-clusters destroyed by these parasites is insufficient to make them of great economic importance.

S. P. **Непарный шелкопрядъ въ Зааминскомъ районѣ.** [The Gipsy Moth near the village of Zaamin (Samarkand).]—**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 4, April 1916, p. 368.

A large outbreak of *Lymantria dispar* occurred in 1915, and owing to the fact that no measures were taken against the eggs, another outbreak is threatened this year. Willows (*Salix caprea*) were mainly attacked. This moth usually ceases to be a pest after three or four years, being kept in check by its parasites.

Sacharov (N.). **Укороченный грушевый пилильщикъ и мѣры борьбы съ нимъ.** [*Micronematus abbreviatus*, Htg., and its control]; published by the Entomological Station of Astrachan, reprint from **«Любитель Природы.»** [*Friend of Nature*], *Petrograd*, 1916, 10 pp., 4 figs.

Though *Micronematus* (*Nematus*) *abbreviatus*, Htg., seriously damages pear trees in Astrachan, it has not been previously recorded as a pest. The author first observed this sawfly about the middle of May, when the

pear trees had been defoliated and the mature larvae were descending the trunks and forming cocoons, mostly in the soil, but also under dead leaves, clods of earth, etc. They remained in this stage until the following spring, when they pupated, the imago appearing on 25th April. Only females were found and it is thought that this species reproduces parthenogenetically. The larvae were parasitised in 1915 to the extent of about 18 per cent., by an Ichneumonid.

The remedies recommended against this pest include:—Spraying with Paris green (½ lb. of green, 1 lb. of lime prepared as milk of lime, and about 39–40 gallons of water, to which 5–7 lb. of molasses may be added as an adhesive), Urania green (1 lb. in about 70 gallons of water and 10–12 lb. of molasses), or London purple (1 lb. in about 90–100 gallons of water and 2 lb. of lime with ½ lb. of molasses). The spraying is best done either before 10 a.m. or after 3 or 4 p.m., after the blossoming is over, otherwise the blooms will be damaged. Tanglefoot belts should be tried at the time when the larvae are migrating down the trunks. The burning of fallen leaves in autumn and disturbance of the soil at the foot of the trees are also useful.

ANDERSON (J.). **The Connection of *Nosema apis* with Isle of Wight Disease in Hive Bees. Remarks on the evidence submitted in the Board of Agriculture Reports of 1912 & 1913.**—*Proc. R. Physical Soc., Edinburgh*, xx, no. 1, September 1916, pp. 16–22.

The Protozoan parasite, *Nosema apis*, was found in 1906 by Drs. Fantham and Porter to be invariably present in bees suffering from Isle of Wight disease. An outbreak of the disease occurred in Lewis, Outer Hebrides, in 1911, and examination of affected insects showed the presence of young stages of *Nosema*. One colony was killed, but another completely recovered. An outbreak of disease appeared in Stornaway in June 1913, in which the crawling symptoms were very marked. Young stages of the parasite were present, but spores were practically wanting. Further investigations in Lewis proved that spores were more abundant in apparently healthy than in diseased bees. Again, the presence of *Nosema* or its spores was only found in 84 per cent. of the diseased bees examined from Stornoway. The results obtained by inoculating healthy bees with *Nosema* spores have not proved conclusively that this parasite was the cause of the mortality observed, as the unnatural conditions under which the experimental bees were kept had a marked effect on their vitality. It was also found that a stock which showed the heaviest *Nosema* infection lived longer than one less heavily infected. The theory that *N. apis* is the cause of Isle of Wight disease is therefore not supported by all the facts observed.

ANDERSON (J.) & RENNIE (J.). **Observations and Experiments bearing on "Isle of Wight" Disease in Hive Bees.**—*Proc. R. Physical Soc., Edinburgh*, xx, no. 1, September 1916, pp. 23–61, 1 plate.

The observations here recorded are grouped under three heads:—(1) those relating to the general characters of the Isle of Wight disease; (2) investigations bearing on the relation of *Nosema apis* to Isle of Wight disease; (3) experiments on the infectivity of the disease as

distinguished from microsporidiosis. In Lewis, Outer Hebrides, 14 outbreaks occurred between 1909 and 1914, the disease appearing in from one week to six months after the introduction of the stock. In one case, the disease lasted a few days, and then recovery followed; another stock showed the disease for several weeks, then recovered, but suffered a second attack in the following year. The remaining stocks died out after varying periods. Spores of *N. apis* were found in only two cases in which symptoms of the disease were shown; young stages occurred in two affected stocks, one of which recovered. Other stocks were found to be infected by *Nosema*, but did not exhibit signs of disease. In Craibstone and Deeside cases of spontaneous recovery were observed, and in some instances bees affected by the disease gave negative results when examined for *Nosema* spores.

Examination of the gut contents of apparently healthy and diseased bees has led to the conclusion that there appears to be no causal relation between the presence of *Nosema* and the disease. Records made in other countries show that spores are as frequent in healthy as in diseased insects. *Nosema* is therefore considered, not as an essential factor, but as one which, by weakening the bees, favours the development of the disease in certain cases. Attempts made to produce infection among healthy bees by feeding with a mixture of honey and pulp obtained from bees which had exhibited the crawling symptoms of the disease, met with negative results. In two instances disease developed after a greater or less interval among swarms which had come from or were introduced into infected hives. It is thus doubtful whether these cases should be regarded as having been directly infected through the hive, or whether infection was due to other sources. The general conclusion deduced from the foregoing facts is that the Isle of Wight disease, although probably infectious, requires the coincidence of other, unknown, external factors for its development. The disease is not necessarily carried by contact with infected hives or combs, or by feeding on infected stores.

Brues (C. T.). **A New Species of *Lepidopria* from North America.**—*Psyche, Boston, Mass.*, xxiii, no. 4, August 1916, pp. 126–127, 1 fig.

The Diapriid, *Lepidopria aberrans*, sp. n., reared from a Tachinid pupa, probably that of *Cryptomeigenia theutis*, found in an adult *Lachnosterna inversa*, is described.

Schoene (W. J.). **The Cabbage Maggot: its Biology and Control.**—*New York Agric. Expt. Sta., Geneva*, Bull. 419, March 1916, pp. 99–160, 3 figs., 8 plates, 15 tables. [Received 13th September 1916.]

Chortophila (Pegomyia) brassicae, Bch., is widely distributed in the British Isles and northern Europe, including Scandinavia, Holland, Switzerland, Germany and Austria, while in America it is found in Canada and in the United States as far south as 40° N. lat. The host plants include cultivated cruciferous crops of all kinds, as well as the wild *Barbarea vulgaris* (winter cress) and *Sisymbrium officinale* (hedge mustard), which are attacked in Europe, and *S. officinale* and *Brassica alba* in America. The host plant selected by the female for the purpose

of egg-laying appears to depend on the degree of succulency and tenderness of growth, rather than on the variety or species of the plant. Injury to cabbage crops in the vicinity of Geneva is restricted to the spring months. In New York it is the custom to leave the cabbage stumps in the ground during the winter; consequently the new growth proves very suitable for egg-laying, with the result that the stumps become thoroughly infested. The normal duration of the larval stage is about three weeks, but in the absence of food and moisture may be considerably reduced. Pupation takes place in the soil close to the host plant, 90 per cent. of pupae of the first brood, found in June, lying within 3 inches of the injured plant and in the first 3 inches of soil. A small number of larvae pupate in infested aerial parts of the host. The duration of the pupal stage under warm conditions varies from 12 to 18 days; in the hibernating generation it is from five to eight months and the larvae migrate from the plant to a distance of 4 or 5 inches.

Emergence of adults in spring extends over a considerable period; in 1911 this lasted from 9th May until 14th June. Under experimental conditions, emergence was able to take place from a depth of 12 inches. Adults kept in captivity fed readily on banana, sugar and water, and on blossoms of *S. officinale*, *Daucus carota*, etc., living for a period of two to four weeks, and in one case for nine weeks. No eggs were deposited in captivity. Eggs are probably deposited in from three to five days after emergence, and are laid either singly or in masses. In the latitude of Geneva three broods usually occur annually and in favourable seasons a partial fourth brood may be produced, while in other years only two broods appear. Observations extending over several years indicate that the winter is passed in the puparium and not in the adult stage, as previous investigators have suggested.

In addition to hot, dry weather the most important natural enemies in this region are Staphylinids belonging to the genus *Aleochara*, the Cynipid parasite, *Pseudoeucoila gillettei*, and a mite, *Trombidium* sp. The commonest Staphylinid is *A. bipustulata*, L.; in addition, *Philonthus nigritulus* and *Homalota sordida* have occasionally been reared from puparia. The following species have been taken near infested plants:—*Tachyporus jocosus*, *Aleochara* sp., near *athata*, *Oxytelus nitidulus* and *Staphylinus badipes*. Parasitisation by *P. gillettei* amounted to 4½ per cent. during August and September 1909. In Minnesota, a parasitisation of 36·6 per cent. has been recorded. *Trombidium sericeum* occurs in large numbers during the oviposition period of *C. brassicae* and is responsible for the destruction of a considerable percentage of eggs. Three species of ants appeared to be predaceous on the eggs, young larvae and adults; these were *Stenamma brevicorne*, Mayr, *Formica fusca*, L. var. *subsericea*, Say, and *Solenopsis molesta*, Say. *Lasius niger*, L. var. *americanus*, Emery, and the Carabid, *Clivina impressifrons*, were observed in the earth near infested plants. Adults were attacked by an Anthomyid, *Caenosia flavifrons*, Stein, by a fungus (*Empusa*), and possibly also by a red mite.

Experiments for the control of the cabbage maggot included attempts to destroy the adults by the use of poisoned bait. Flies in captivity died in less than two hours after feeding on a sweetened solution of a soluble arsenic compound. A spray consisting of 2 lb. molasses,

3 oz. lead arsenate paste, and 4 gals. water, used in the field, gave apparently no results. Adults which were observed to feed on the spray lived in captivity for two weeks or longer. Potassium arsenate substituted for the lead compound was much more effective when sprayed on to weeds and grass near a cabbage seed-bed. This spray may therefore afford a certain degree of protection from the attacks of this pest. Tarred paper disks covered with tanglefoot and placed round cabbage plants captured large numbers of adults. These disks were however liable to become coated with dust during windy weather and thus lose some degree of efficiency. Injury to seed-beds can be almost entirely prevented by screening with cheesecloth of 20 to 30 threads per inch; this procedure also reduces injury by flea-beetles. Cultural measures to lessen maggot injury include the removal of stumps in autumn and the growth of seedlings as far as possible from the final position of planting.

CRAWLEY (W. C.). **Ants from British Guiana.**—*Ann. Mag. Nat. Hist., London*, Ser. 8, xvii, no. 5, May 1916, pp. 366–378. [Reprint received 17th September 1916.]

The ants of economic importance recorded in this paper include:—*Ectatomma quadridens*, F., found in cane-fields, attacking the eggs and larvae of *Diatraea saccharalis* and the larvae of *Metamasius hemipterus*; *Neoponera villosa*, F., subsp. *inversa*, Sm., in holes in the trunks of cacao; *Monomorium floricola*, Jerd., in coconut; *Solenopsis geminata*, F., in hollow stems of plants and in houses; *S. corticalis*, For., subsp. *amazonensis*, For., infesting food-stuffs, especially sweet oils, sugar, and milk; *Tetramorium guineense*, F., occurring in cane-fields, attendant on *Ripersia* sp. (mealy bug of sugar-cane), and on *Pseudococcus citri*, Risso, in cacao pods; *Cryptocerus pusillus*, Klug, attending *Pulvinaria pyriformis*, Ckll., and *Coccus hesperidum*, L.; *Atta cephalotes*, L., attacking the leaves of *Hevea braziliensis* (Para rubber); *A. mölleri*, For., subsp. *meinerti*, For., var. *globoculis*, For., attacking *H. braziliensis* and foodstuffs; *Dolichoderus bidens*, L., a leaf-rolling species, especially of coffee; and *Azteca schimperi*, Em., forming nests on the tree-trunks, especially of mangos.

BRUCH (C.). **Un nuevo Ipido (=Escolítido) de Chile (*Phloeotribus porteri*, n. spec.)** [A new Chilian Scolytid (*Phloeotribus porteri*, sp. n.]—*Anales Zool. Aplicada, Santiago de Chile*, i, no. 1, 30th April 1914, pp. 25–27, 5 figs. [Received 4th September 1916.]

A figure and description are given of a new Scolytid, *Phloeotribus porteri*, found on plum trees (*Prunus domestica*, L.) near Concepcion and on peaches (*Amygdalus persica*, L.) near Santiago.

BRÈTHES (J.). **Description d'un nouveau *Prionomitus* du Chile.** [Description of a new Chilian *Prionomitus*.]—*Anales Zool. Aplicada, Santiago de Chile*, i, no. 1, 30th April 1914, pp. 29–30, 1 fig. [Received 4th September 1916.]

A description is given of *Prionomitus aulacaspidis*, sp. n., an Encyrtid bred from *Aulacapis rosae*, Bch., collected near Santiago.

PORTER (C. E.). **Notas de Parasitología.** [Notes on Parasitology.]—*Anales Zool. Aplicada, Santiago de Chile*, i, no. 1, 30th April 1914, pp. 42–43, 1 fig. [Received 4th September 1916.]

Bruchus ferrugineipennis, Blanch., is recorded from Tarapacá, where it was found on *Prosopis tamarugo*, Phil.

PORTER (C. E.). **Materiales para la Entomología económica de Chile.** [Contributions to the Economic Entomology of Chili.]—*Anales Zool. Aplicada, Santiago de Chile*, i, no. 1, 30th April 1914, pp. 65–79, 8 figs. [Received 4th September 1916.]

Scale-insects occurring in Chili include:—*Pseudococcus citri*, Risso, *Chrysomphalus* (*P.*) *aonidum*, L., and *P. vitis*, Nied. *Asterolecanium variolosum*, Ratz., has been found on oak near Temuco, which greatly extends its known area of distribution, restricted hitherto to Europe, Canada and the United States. [It has been for some time a serious pest in South Africa.—Ed.] In 1913, a new Coccid, probably belonging to the genus *Dinaspis*, was found on *Maytenus boaria*, Mol., near Temuco.

PORTER (C. E.). **Notas de Parasitología.** [Notes on Parasitology.]—*Anales Zool. Aplicada, Santiago de Chile*, ii, no. 1, 30th April 1915, p. 12. [Received 4th September 1916.]

A Hymenopteron, probably a species of *Apanteles*, is recorded as having been bred from the larvae of *Orgyia antiqua*.

BRÈTHES (J.). **Description d'un Braconidae et d'un Proctotrupidae du Chili.** [Description of a Chilian Braconid and Proctotrupid.]—*Anales Zool. Aplicada, Santiago de Chile*, ii, no. 1, 30th April 1915, pp. 13–14, 1 fig. [Received 4th September 1916.]

A Braconid, *Aphidius porteri*, sp. n., and a Proctotrupid, *Polygnotus chilensis*, sp. n., are described from Santiago.

PORTER (C. E.). **Materiales para la Entomología económica de Chile: IV. Notas sobre los Tisanópteros.** [Contributions to the Economic Entomology of Chili. IV. Notes on the Thysanoptera.]—*Anales Zool. Aplicada, Santiago de Chile*, ii, no. 2, 30th June 1915, pp. 17–26, 2 figs., 1 plate. [Received 4th September 1916.]

The occurrence in Chili of *Heliothrips haemorrhoidalis*, Bch., and of another species of thrips, believed to be new to science, taken on the leaves of *Cryptocarya peumus*, is recorded.

PORTER (C. E.). **Descripción de un nuevo díptero chileno.** [Description of a new Chilian Dipteron.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, pp. 14–15, 1 fig. [Received 4th September 1916.]

Agromyza gayi, sp. n., taken on a plum tree (*Prunus domestica*, L.) near Santiago, is described.

PAILLOT (A.). **El gusano de las manzanas** (*Carpocapsa pomonella*). [The apple worm, *Cydia pomonella*.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, pp. 16-23, 2 figs. [Received 4th September 1916.]

This paper gives an account of the life-history and control of *Cydia pomonella*, and has been translated from the French for the benefit of readers in Spanish America.

BRÈTHES (J.). **Description de deux hymenoptères chiliens.** [Description of two Chilian Hymenoptera.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, pp. 24-27, 2 figs. [Received 4th September 1916.]

Tetrastichodes xenocles, Wlk., a parasite of *Ceroplastes* sp., *Pteroptrix australis*, sp. n., a parasite of *Aleurodes* sp., and *Heterobelyta chilensis*, gen. et sp. n., a hyperparasite of *Lepidosaphes beckii*, are described.

PORTER (C. E.). **Un pajarillo destructor de pulgones.** [A small bird destroying plant lice.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, p. 30. [Received 4th September 1916.]

The small Chilian bird, *Leptasthenura aegithaloides*, is recorded as destroying rose Aphids.

GIACOMELLI (E.). **Lepidópteros de La Rioja (Rep. Argent.) que se sabe o se supone son dañosos a la Agricultura.** [Lepidoptera of La Rioja (Argentina) known or supposed to be injurious to agriculture.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, pp. 31-32.

The following insects occur in the province of La Rioja, but do not cause important injury there:—*Colias lesbia*, L., on *Medicago sativa* (lucerne); *Tatochila autodice*, Hb., thought to attack Cruciferae such as *Brassica*, *Sinapis*, etc.; *Papilio thoas*, L. on *Citrus*; *Eudamus proteus*, L., on *Phaseolus*; *Pieris monuste*, L., said to be a pest of the peach, though this is doubtful; *Chloridea obsoleta*, on tomatoes and maize; the bagworms, *Oeceticus platensis*, Berg, and *O. geyeri*, Berg, on various trees; *Diaphania hyalinata*, L., (*Phacellura hyalinatalis*, Guen.), on "zapallo."

GALLARDO (A.). **Introducción de la *Diaspis pentagona* y lucha contra esta plaga en la Rep. Argentina.** [The introduction of *Aulacaspis pentagona* and its control in Argentina.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, pp. 33-50. [Received 4th September 1916.]

This paper traces the history of the introduction of *Aulacaspis pentagona* into Argentina and its successful control there by *Prospaltella berlesei*.

PORTER (C. E.). **Materiales para la Entomología económica de Chile: VI. El género *Icerya*, Sig.** [Contributions to the Economic Entomology of Chili. The genus *Icerya*.]—*Anales Zool. Aplicada, Santiago de Chile*, iii, no. 1, 29th February 1916, pp. 51–54, 2 figs. [Received 4th September 1916.]

The only known Chilian representative of the genus *Icerya* is *Icerya palmeri*, which attacks *Acaena argentea*, the grape vine, lucerne and other plants.

Auftreten und Bekämpfung der Reblaus im Kanton Zürich 1913–1915. [The presence and control of *Phylloxera* in the Canton of Zürich in 1913–1915.]—*Schweiz. Zeitschr. für Obst- u. Weinbau, Frauenfeld*, xxv, no. 17, 28th August 1916, pp. 270–271.

The data in this paper are taken from the last report of the Zürich Phylloxera Commissioner. In the period 1913–1915, 109 areas with 448 infested stocks were found, additional to the previous infestation [see this *Review*, Ser. A, ii, p. 127]. About half of the new infestation was found in 1915, a year in which carbon bisulphide was not procurable, so that petroleum had to be used instead. Up to the time of writing, this treatment seemed to have been successful. No flavour of petroleum was communicated to the grape juice. The area planted with vines was 13,797 acres in 1881 and only 6,002 in 1914.

MALENOTTI (E.). **Sulle pretese varietà del "*Chrysomphalus dictyospermi*" (Morg.) Leon.** [On the supposed varieties of *Chrysomphalus dictyospermi*.]—Separate, dated 28th July 1916, from *Redia, Florence*, xii, no. 1, pp. 109–123, 6 figs. [Received 7th September 1916.]

The author does not believe that true varieties exist among the known forms of *Chrysomphalus dictyospermi*. This scale-insect infests at least eighty different species of plants belonging to about twenty-five widely dissimilar families in both tropical and temperate climates, both greenhouse and outdoor plants being attacked. A marked tendency to vary, together with the wide distribution and great range of host plants of this species sufficiently explain the existence of a multitude of local forms, which are insufficiently fixed to be treated as distinct varieties.

LIMA (A. da Costa). **Sobre alguns Curculionidas que vivem nos bambús.** [On some Curculionids living in bamboo stems.] *Mem. Inst. Oswaldo Cruz, Rio de Janeiro*, viii, no. 1, 1916, pp. 41–43.

Additional bamboo-infesting weevils are dealt with in this paper [see this *Review*, Ser. A, iii, pp. 306 and 696]. They include *Rhinastus pertusus*, Dalm., on *Chusquea gaudichaudii*, *Desmosomus longipes*, Perty, and *Astyage punctulata*, sp. n., in the internodes of *Merostachys claussenii*.

The opinion is expressed that the weevil recorded by Bondar on coconut and other palms in the State of São Paulo, as *Amerrhinus pantherinus*, Ol. [see this *Review*, Ser. A, iv, p. 220], is in reality *A. ynca*, Sahlb. Other Brazilian palms are infested by *Homalonotus coriaceus*, Gyl., *H. deplanatus*, Sahlb., and *Acharias* (*Cholus*) *parcus*, Fhs.

STRICKLAND (E. H.). **The March fly** (*Bibio abbreviatus*) **in grain fields and as a pest of celery.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 7, July 1916, pp. 600–603, 3 figs. [Received 6th September 1916.]

In the autumn of 1913 and again in 1914 celery plants at Lethbridge were damaged by the larvae of *Bibio abbreviatus* (March fly). This appears to be an exceptional habit of these larvae, which feed for the most part on decaying material and are likely to be found in immense numbers where there has been a heavy application of farm yard manure. They also abound in places which contain rotting vegetation. The dates of oviposition and the early stages are unknown, but by the end of October all the larvae are full-grown. In this condition the winter is passed at a varying depth in the soil. Early in April the larvae begin to work their way towards the surface of the soil and pupate. The larvae are distinctly gregarious, both in autumn and spring, and the pupae are usually found in groups of a dozen or more, though each inhabits a separate cavity. The adults begin to hatch in about 10 days, the first appearing on 10th May. Though the larvae of *B. abbreviatus* have not been often recorded as of economic importance, they have occasionally been reported as pests of rhubarb, both in England and America. Another species, *B. gracilis*, has also been found damaging autumn wheat in Canada and elsewhere. The damage to celery consists of the destruction of the soft pulp between the fibro-vascular bundles of the stalks, and where a large number of larvae are present, the whole of the underground portion may be affected. The attacked areas turn brown during the late summer and autumn and are the seat of infection for various fungus diseases and small Dipterous larvae, such as those of *Drosophila*, which soon render the plants unfit for sale. Celery beds are heavily manured, and the larvae live and usually mature in the manure. When the celery is earthed up in August, many of them are brought into contact with the pulpy flesh of the stalks and apparently prefer it to their normal food. Earthing up should therefore be avoided in places where these larvae are numerous. Bleaching celery between boards, or prepared paper, has been tested at Lethbridge with good results and is recommended.

MACDOUGALL (R. S.). **Insect and Arachnid Pests of 1915.**—*Trans. Highland & Agric. Soc. Scotland*, 1916, pp. 1–33, 13 figs. [Reprint received 13th September 1916.]

Larvae of *Merodon equestris* and *Eumerus strigatus* (narcissus flies) were found in bulbs of *Narcissus poeticus*. *Otiorrhynchus sulcatus* (black vine weevil) was reported as injurious to cyclamens under glass. The adults of this species may be trapped by means of sacking or hay placed round the plant or by shaking from the plants at night, while the larvae attacking the roots may be destroyed by incorporating naphthaline or vaporite with the soil. *Acherontia atropos* was found in a bee-hive in Kirkcudbrightshire. Adults of *Amorpha* (*Smerinthus*) *populi* (poplar hawk moth) appeared in June and July, the larvae being recorded on poplar, elm and some garden plants. *Hepialus humuli* (ghost swift moth) was found on herbaceous plants. *Meligethes aeneus* (turnip flower beetle) was reported from Fife during June on the flowers of *Raphanus raphanistrum* and *Sinapis arvensis*. The eggs

are laid in the opening buds; the larva feeds in the flowers until mature, then enters the ground to pupate; cultivated crucifers are frequently attacked. *Phyllopertha horticola* (smaller June bug) occurred in a lawn in one district; the adults attack the leaves and fruit of orchard trees and the leaves and flowers of roses, while the larvae feed on the roots of grass, clover, cabbage and other garden plants. Cabbages were attacked by *Baris*, *Chortophila* (*Phorbia*) *brassicae*, and *Phytomyza flavicornis*. Other pests recorded include *Pulvinaria vitis* var. *ribesiae* (woolly currant scale) on *Ribes sanguineum*, *Lytta vesicatoria* (blister beetle) on ash, lilac, privet, etc., *Cryptorrhynchus lapathi* (willow beetle) on willows, *Pissodes pini* on pines, *Myelophilus* (*Hylurgus*) *minor* in young shoots and under the bark of pine, and the sawfly, *Cryptocampus medullarius*, Hart. (*Euura pentandrae*, Thom.) in twigs of willow.

MacDougall (R. S.). *Sinodendron cylindricum*, L., **and related Lamellicorns.**—*Trans. R. Scottish Arboricultural Soc.*, 1916, pp. 50-55, 2 plates. [Reprint received 13th September 1916.]

Larvae in all stages of development and adults of *Sinodendron cylindricum* were obtained in Scotland during October from the dead trunks of ash and elm at a distance of from 4 to 10 feet above the ground. This beetle, which is rare in Scotland, has also been found on oak, beech and willow. A related species, *Dorcus parallelipipedus*, L., has been obtained from broken and decaying stems of ash, elm and walnut.

The diagnostic characters of the families Lucanidae and Scarabaeidae are given, together with keys to the identification of the adults and larvae of the British species of the Lucanid genera, *Sinodendron*, *Dorcus*, and *Lucanus*, and those of the Scarabaeid genera, *Melolontha*, *Cetonia*, and *Gnorimus*.

Sands (W. N.). **Additional Notes on the Native Food-Plants and Feeding Habits of the Cotton Stainer in St. Vincent.**—*Agric. News, Barbados*, xv, no. 373, 12th August 1916, p. 267.

Eriodendron anfractuosum and *Thespesia populnea* have been definitely proved to be sources of infection from which *Dysdercus delauneyi*, Leth. (cotton stainer) can be carried to young cotton fields. In both the Leeward and Windward districts of St. Vincent, cotton was attacked by stainers from these trees and showed a high percentage of internal boll disease during July. Stainers were found during the same month in the vicinity of the trees feeding on seeds disseminated by the wind. The local Government proposes to pass an Ordinance which will enable the Agricultural Department to take such action as may be deemed necessary to control this pest.

Jarvis (E.). **On the Value of Poison Bait for Controlling Cane Grubs.**—*Queensland Bureau of Sugar Expt. Sta., Div. Entom., Brisbane*, Bull. no. 4, 1916, 14 pp., 1 plate, 2 tables. [Received 13th September 1916.]

This bulletin contains the results of laboratory experiments on the control of the larvae of *Lepidiota albohirta* by means of poisoned baits.

The foliage of cowpeas, both in a fresh and a decaying condition was found to be very attractive to the larvae. Tests were therefore made to determine whether this attractiveness was maintained in the presence of arsenicals, and whether the latter were effective in destroying the grubs. Cowpea foliage, which had been previously sprayed with molasses (1 pt. to 3 pts. water) and dusted with Paris green (100 per cent.), was buried to a depth of 2 inches in soil containing a number of larvae. Subsequent examination showed that a quantity of the foliage had been eaten and the mortality among the larvae amounted to 90 per cent. in 16 days. Decaying leaves treated as above caused a mortality of 100 per cent. and remained palatable for at least 27 days. When mixed with three times its weight of flour, Paris green proved fatal to 100 per cent. of larvae in 25 days. Leaves treated with white arsenic (100 per cent.) retained their efficiency for at least a month and destroyed 100 per cent. of larvae. When diluted with flour, as in the previous experiment, the resulting mortality did not exceed 33·3 per cent. White arsenic, although much less efficient in the diluted form, has the advantage of being about one-sixth of the cost of Paris green. The total cost of labour and undiluted white arsenic for use on a large scale would not exceed 12*s*. 6*d*. per acre. In the field, cowpeas should be sown about three weeks after the first appearance of the adult beetles. The plants would then be ready to spray, dust and plough in, about four weeks later. It is proposed to carry out field investigations in connection with this method of control during the next season.

JARVIS (E.). **A New Insect Pest of Sugar-Cane.**—*Queensland Agric. Jl., Brisbane,* vi, no. 2, August 1916, pp. 102-103.

Melanitis leda, L., was found in small numbers in plantations of young canes in the neighbourhood of Gordonvale. This butterfly is widely distributed in Australia and also occurs in New Guinea. Egg-masses, containing from three to eight eggs, are found on the under side of the leaves, the larvae feeding on the foliage of sugar-cane and grass. The pupae were attacked by a disease, possibly of a bacterial nature. *Parnara mathias* appeared to be widely distributed. The eggs of this butterfly are laid singly on the upper side of cane leaves. The larvae are attacked by a Braconid and a Tachinid parasite. *Telicota augias kreffti* was also found during the month.

Smoking out Rutherglen Bug.—*Agric. Gaz. N.S.W., Sydney,* xxvii, no. 7, July 1916, p. 488.

In 1914 the Rutherglen bug [*Nysius vinitor*] was so numerous in an orchard that the owner only obtained 100 boxes of apricots. In the following year sheep manure was deposited in heaps on the south-west side of the orchard, from which quarter there was a night breeze in the early summer. Sulphur was mixed with these heaps, and when they were burnt, the fumes were so strong that it was not possible to cross the orchard in the early morning. The resulting crop comprised more than 3,000 boxes of apricots and no traces of the bug could be detected. It is considered probable that any material giving rise to a dense smoke would be effective in driving these insects out.

Burkill (I. H.). Annual Report of the Director of Gardens, Straits Settlements, for the Year 1915.—*Singapore*, 1916, 7 pp. [Received 14th September 1916.]

The following insect pests were observed during the year:— Lepidoptera: *Calogramma festiva* on leaves of *Crinum asiaticum*; *Catochrysops pandava* on cycads; *Erionota thrax* on foliage of pisang and Manila hemp; the larvae of a Microlepidopteron on avocado pear; the larvae of a moth resembling *Zeuzera coffeae* in stems of *Bauhinia candida*; and *Brachartona catoxantha* on nipa and coconut palms, the pupating larvae of which were killed in considerable numbers by the fungus, *Botrytis necans*. Coleoptera: *Rhynchophorus ferrugineus* on *Cocos*; *Xylotrupes gideon* in stems of *Pinanga*; an undetermined beetle on leaves of *Nymphaea*.

Storey (G.). List of Egyptian Insects in the Collection of the Ministry of Agriculture.—*Minist. Agric., Cairo, Tech. & Scient. Service*, Bull. no. 5 (Entom. Sect.), 12th March 1916, 52 pp. [Received 14th September 1916.]

This list includes a number of species of economic importance. The collection has been brought together during the past four years mainly with a view to assisting work on economic entomology.

Gough (L.). Note on a machine to kill *Gelechia* larvae by hot air, and the effects of heat on *Gelechia* larvae and cotton seed.—*Minist. Agric., Cairo*, Tech. & Scient. Service, Bull. no. 6 (Entom. Sect.), 12th March 1916, 18 pp. [Received 14th September 1916.]

This hot-air machine for killing the larvae of *Gelechia gossypiella* is the outcome of previous work [see this *Review*, Ser. A, iii, p. 505; iv, p. 230] and is a simple apparatus, consisting mainly of a furnace for the generation of the hot air, a hot air chamber through which the seed passes, and a motor. The chamber is a box of iron, insulated to prevent loss of heat and containing four endless bands made of iron chains, with trays on which the seed is carried. By means of a contrivance, the seed, after having been carried nearly the whole journey of the upper surface of the upper part of a band, is discharged on to the upper surface of the lower part of the same band, from which, after travelling nearly the whole journey, it is again discharged on to the upper surface of the upper part of the next band, and so on, until finally it is discharged into an Archimedean screw conveyor which carries it into the sacking exit. The seed is introduced by an automatic hopper, which drops in exactly the quantity of seed required to make a layer one seed deep on the endless bands. A fan causes a continuous current of air to circulate through the machine. The air is exhausted from the hot air generator, a brick chamber surrounding the furnace, the temperature being regulated by a damper interposed between the generator and the hot air chamber. A thermometer shows when the damper should be worked and it is proposed to fit a thermo-regulator attachment which would do away with hand control entirely. In working the machine the factors to be considered are:—(1) the temperature of the seed when entering the machine; (2) the time required to pass through the machine; (3) the temperature the machine is regulated to give;

(4) the temperature of the seed at the exit. Of these four factors the last is the most important, and the other three must be regulated so as to keep the temperature of the seed at the exit between 119° F. and 131° F., the best temperature to maintain being 122° F. A series of four tables gives the results obtained, showing that there is ample limit for regulation in such a way as to kill the caterpillars without damaging the seed. The injury to the seed can be estimated by germination tests made directly after treatment. No further falling off of germination is observable after the lapse of three weeks. On the other hand, the mortality of the caterpillars is not instantly complete, some individuals occasionally surviving treatment for a few days. The temperature in certain parts of the machine may rise very high, up to 338° F., without danger to the seed. This is because the temperatures read are taken from the sides of the machine, and are not actually those of the carriers, and also because the seed is not exposed for sufficient time to the maximum temperature.

ANDRES (A.). **Sur une plante nourricière de *Hypolycaena* (*Virachola*) *livia*, Klug.** [A host-plant of *Hypolycaena* (*Virachola*) *livia*, Klug.]—*Bull. Soc. Entom. d'Egypte, Cairo*, Years 1914–1915 (1916), pp. 88–89.

Virachola livia, Klug, is recorded on *Inga dulcis*, which must therefore be added to the host-plants of this pest of pomegranates.

PIC (M.). **Observations concernant certains Altisides et renseignements sur ceux d'Egypte.** [Remarks on certain Halticidae with particulars of Egyptian species.]—*Bull. Soc. Entom. d'Egypte, Cairo*, Years 1914–1915 (1916), pp. 123–130.

This paper contains some general information on Egyptian flea-beetles, about which but little is known at present. Among the species mentioned are *Chaetocnema aridula*, Gyll., *C. tibialis*, Ill., *Phyllotreta cruciferae*, Goeze, *P. rufitarsis*, All., and *Haltica ampelophaga*, Guér.

BARBER (E. R.). **The Argentine Ant: Distribution and Control in the United States.**—*U.S. Dept. Agric., Washington, D.C.*, Bull. no. 377, 18th August 1916, 23 pp., 4 figs., 1 table.

Iridomyrmex humilis, Mayr, occurs in the southern parts of the United States, from the eastern part of Texas to the Atlantic coast and from the Gulf of Mexico northwards to Tennessee. This ant seriously infests food substances of all kinds in stores and houses, and in the field is often associated with Aphids and scale-insects. Dispersal is dependent to a very considerable degree on the available food supply, being more rapid when food is scarce. Observations made at several points indicate that the normal rate of advance is from 300 to 400 feet a year. Distribution is effected by floods, which occur at least twice each year in the Mississippi Valley, by steamers and by railways. The summer nest occurs under the sills of houses, in piles of bricks or stones, under boards, etc. Hibernation takes place at the bases of trees, in manure heaps or other decomposing matter in which heat is generated. In an artificial formicary a fertilised queen lays from 3 to 30 eggs a day.

The average duration of the incubation period in summer is about 15 days, and that of the larval period during the same season about 13 days. The duration of the pupal stage of the worker in the summer averages 13 days and that of the male 22 days.

Heavy rains and floods, in addition to acting as factors in dispersal in that they cause the floating of logs, etc., containing nests, act to a certain degree as controlling agencies, especially during cold weather, when the ants are in a more or less dormant condition. Artificial barriers for outdoor use take the form of sticky bands round trees, beehive stands, etc. The addition of 5 per cent. of carbolised oil to the substance ordinarily used for coating flypapers prevents the growth of moulds on the surface of the band in wet weather. The addition of bichloride of mercury or nicotine sulphate prolongs the effectiveness of the adhesive. In infested houses, tables, refrigerators, etc., may be protected by placing the legs in saucers filled with naphthaline or coal oil, or by banding the legs with tape saturated with bichloride of mercury. An attractive poisoned bait, which has proved satisfactory, consists of :—15 lb. granulated sugar, 8 pts. water, ¼ oz. tartaric acid, ¾ oz. sodium arsenite, 1½ lb. honey. This bait proved attractive at all seasons of the year. When placed in suitable containers outside houses, ants ceased to invade the latter and were found in large numbers visiting the bait. Paraffin-covered paper bags containing a small quantity of the syrup and a piece of sponge were found very satisfactory for using on trees. The extended use of this poison is recommended. Hibernating ants in rural districts may be attracted to trap boxes filled with decaying vegetation, which can then be fumigated with carbon bisulphide.

EHRHORN (E. M.). **Division of Entomology : Annual Report for 1915.** —*Hawaiian Forester and Agriculturist, Honolulu,* xiii, no. 7, July 1916, pp. 240–242. [Received 19th September 1916.]

The work of the division included the inspection of imported plants, fruits, etc., and the breeding and liberation of parasites of important insect pests. The following parasites of the fruit-fly were liberated :— *Opius humilis, Diachasma fullawayi, D. tryoni, Tetrastichus giffardi, Dirhinus giffardi* and *Galesus silvestrii.* Parasites of the horn-fly, stable-fly and house-fly which were liberated, included *Muscidifurax vorax,* an undetermined African *Spalangia,* an undetermined Philippine *Spalangia,* and an undetermined Philippine Pteromalid. Efforts were made to obtain parasites of *Dacus cucurbitae* (melon fly).

Paralipsa modesta (rice moth) was observed on a few occasions in beans from Japan.

EHRHORN (E. M.). **Report of the Division of Entomology for June.**—*Hawaiian Forester and Agriculturist, Honolulu,* xiii, no. 7, July 1916, pp. 243–246. [Received 19th September 1916.]

The following pests were intercepted :—Red spider on hydrangea ; Aphids on roses and hydrangea from California ; red spider on roses from California ; Aphids on bulbs of gladiolus.

Parasites of *Ceratitis capitata* and *Opius fletcheri,* a parasite of the melon fly [*Dacus cucurbitae*], were liberated.

SMITH (H. S.). **Beet Leaf-hopper Parasites.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 8, August 1916, p. 299.

A colony of the Chalcid, *Ootetrastichus beatus* was received from Hawaii for use against the sugar-beet leaf-hopper [*Eutettix tenella*] in California. This parasite is an important enemy of the sugar-cane leaf-hopper [*Perkinsiella saccharicida*] in Hawaii and as it is known to breed upon other Jassids, may prove of value against the species attacking sugar-beet.

BRANIGAN (E. J.). **A Satisfactory Method of Rearing Mealy Bugs for Use in Parasite Work.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 8, August 1916, pp. 304–306, 2 figs.

Sprouting potatoes placed in trays containing a layer of moist sand proved very satisfactory for rearing large numbers of mealy bugs. The preliminary supply of scales was obtained from lemons or potato shoots. The trays were contained in a large cupboard-like cage placed in a warm greenhouse. When the supply of mealy bugs in any tray was exhausted, the latter was placed at the bottom of the cage, so that the Coccinellid larvae which were present could crawl up to a new source of food supply. This method of breeding will probably prove useful when enemies of mealy bugs are required to be transported over long distances.

MASKEW (F.). **Quarantine Division; Report for the Month of June 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, v, no. 8, August 1916, pp. 308–309.

The following insect pests were intercepted:—From China: *Chrysomphalus rossi* on boxwood. From Central America: *Aspidiotus cyanophylli, Selenaspidus articulatus* and *Pseudococcus* sp. on bananas. From Hawaii: *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Coccus longulus* on betel leaves; *Chrysomphalus aonidum* on green coconuts; *Lepidosaphes* sp., *Parlatoria* sp., *Pseudococcus* sp., *Howardia biclavis, Pseudococcus adonidum* (*longispinus*), *Chrysomphalus* sp., *Orthezia* sp., *Eucalymnatus perforatus, Coccus longulus, Hemichionaspis minor* and *Thrips* sp. on unknown plants. From Japan: weevil larvae in sweet potatoes; *Lepidosaphes beckii, Pseudaonidia trilobitiformis* and *Parlatoria pergandii* on lemons; a Coccid on bamboo; Lepidopterous larvae in dried persimmons; *Pseudococcus* sp., *Phytomyza* sp., *Thrips* sp., and Tipulid larvae in soil on iris plants. From Mexico: *Lepidosaphes beckii* on limes; Lepidopterous larvae in maize cobs; *Anastrepha* (*Trypeta*) *ludens* in mangos. From Tahiti; *Morganella maskelli* and *Lepidosaphes beckii* on oranges. From Pennsylvania: *Cerataphis lataniae* on Kentia palms; *Aleurodes* (*Dialeurodes*) *citri* on gardenias; *Hemichionaspis aspidistrae* and *Saissetia hemisphaerica* on ferns. From Florida: *Lepidosaphes* sp. on grapefruit; *Pseudococcus* sp. on pineapple. From New Jersey: *Pseudoccus* sp. and *Coccus hesperidum* on *Cocoloba pubescens*. From Victoria, B.C.: *Chionaspis pinifoliae* on *Baga hookeriana*.

The Grape Leaf-Hopper.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 35, 7th September 1916.

For controlling the grape leaf-hopper [*Typhlocyba comes*] in Pennsylvania spraying with Black Leaf 40, 1 part in 150 of water, whale oil soap, 1 lb. in 6 or 7 gals. water, or kerosene emulsion, 1 part stock solution in from 8 to 10 parts water, should be carried out during the first week in July. The spray should be applied to the under side of the leaves at a pressure of about 125 lb.

Treatment for Aster Bugs.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 36, 14th September 1916.

Aster bugs [? *Cantharis stygica*, Lec.] are usually abundant in Pennsylvania during autumn. The larval stage is passed in the soil, and the food during this period consists of eggs of grasshoppers. Hibernation takes place in the soil and adults emerge in the following summer. Leaves and flowers form the food during the adult stage. When very numerous, adults may be killed by spraying the host plants with lead arsenate at the rate of 1 oz. to 1 U.S. gal. water, by beating off the host, or by shaking into cloths soaked in kerosene or tar or into pans containing water and a layer of kerosene.

DAVIS (J. J.) & SATTERTHWAIT (A. F.). **Life-History Studies of *Cirphis unipuncta*, the True Army Worm.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 21, 21st August 1916, pp. 799-812, 2 figs., 1 plate, 3 tables.

Adults of *Cirphis* (*Heliophila*) *unipuncta*, Haw., were first observed at La Fayette during 1915 on the night of 13th May feeding on the honeydew produced by *Pulvinaria vitis*, L., *Eulecanium* (*Lecanium*) *quercifex*, Fitch, and *Callipterus discolor*, Mon., on white oak. Specimens were collected and kept in captivity in order to determine the number of annual generations in that latitude. Under outdoor conditions, larvae arising from eggs deposited by these moths were first observed on 7th June. Pupae were found on 27th June and adults on 8th July. Eggs of the next generation were found on 14th July, larvae on 20th July and the first adults on 30th August. Eggs of the third generation were first noticed on 25th September and larvae three days later. These larvae hibernated while still immature and completed development during the following April. From further observations it appears that a partial fourth generation can arise in some seasons. Under outdoor conditions the total life-cycle occupies about 68 days. The amount of maize foliage consumed by the larvae in the various instars was determined. The average for 108 individuals was 41·394 square inches, of which 34·128 square inches were eaten during the fifth or last instar. This fact explains the destructive action of nearly full-grown larvae.

The eggs of *C. unipuncta* are laid at night in masses of from 25 to 134 on grass, oats, barley, maize, etc., between overlapping leaves fastened together or between the leaf-sheaths. The largest number of eggs

observed to be laid by one female was 234, but many more in various stages of development remained in the ovaries after death. Young larvae feed on the parenchyma of the leaf, but in the later stages eat the entire leaf tissue. Pupation under natural conditions takes place in the ground or under or among rubbish, a thin cocoon being previously formed.

CUSHMAN (R. A.). *Thersilochus conotracheli*, a **Parasite of the Plum Curculio.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 22, 28th August 1916, pp. 847-856, 9 figs., 1 plate, 1 table.

The Ichneumonid, *Thersilochus conotracheli*, Riley, is the most effective parasite of *Conotrachelus nenuphar*, Herbst, in Pennsylvania. This species is apparently confined to *C. nenuphar*, from which it has been also bred in Connecticut, New York, New Jersey, Illinois, Missouri and Kansas. Adults of *T. conotracheli* emerge from their cocoons between the end of May and the beginning of June. Females kept in captivity and fed on syrup and water, lived from 10 to 15 days; those not supplied with food or water lived from one to four days. The eggs are deposited in the young weevil larvae before the latter have burrowed into the fruit to any considerable depth. The maximum length of the incubation period is six days. During the greater part of the larval stage *T. conotracheli* is an internal parasite, but feeds externally for a short time when approaching maturity. Maturity is reached after the host has entered the ground and constructed its pupal cell. Pupation occurs outside the body of the host. The duration of the pupal stage is short, since adults have been found within the cocoons as early as 28th August, though emergence does not take place until the following spring.

Descriptions are given of the developmental stages and a short bibliography is appended.

COOLEY (R. A.). **Observations on the Life-History of the Army Cutworm,** *Chorizagrotis auxiliaris*.—*Jl. Agric. Research, Washington, D.C.*, vi, no. 23, 4th September 1916, pp. 871-881.

Euxoa (Chorizagrotis) auxiliaris, Grote, is an important pest of crops in the north-western parts of the United States. Egg-laying was observed between 30th September and 12th October, 1915. Eggs are deposited during the late afternoon in soil which has been recently ploughed and harrowed. No attempt is made to oviposit on vegetation and in many instances the moths have been seen to fly from grass or stubble fields to adjoining ploughed fields. Activity reaches a maximum at temperatures from 60° to 70° F. The eggs are usually placed two or three together on the underside of clods of earth, and in one field examined the total number deposited averaged one or two per square foot. Egg-laying is not necessarily confined to bare soil, since an outbreak of this cutworm occurred in Utah in lucerne fields which had not been ploughed in the previous autumn. The plants however were some distance apart and eggs were probably placed on the bare soil between them. The duration of the egg-laying period in the field is at least two weeks. In the insectary, the incubation period

varied from 9 to 21 days, with an average of 16·7 days. The prolongation of this period is, in many cases, undoubtedly due to drought. In Fergus county, young larvae were abundant in grain fields on 4th and 5th November 1915. On 10th April 1916, larvae in the same fields were still small, and therefore must have hibernated in an immature stage. From observations made in 1906, it was found that hibernation took place at or near the surface of the soil. In Montana, activity was resumed at the end of March or beginning of April, and reached a maximum about the third week of that month. Pupation was practically complete by 10th May. Pupae occurred in earthen cells about 2 inches below the surface. The duration of this stage in the insectary varied from 43 to 63 days, with an average of 54·7 days, while in the field the duration was about 60 days. Emergence of adults occurred from the latter part of June to the middle of July. Maturity on the part of the females was reached in September, when oviposition took place. This species has therefore one generation annually in the latitude of Montana.

DAVIS (J. J.). *Aphidoletes meridionalis*, **an Important Dipterous Enemy of Aphids.**—*Jl. Agric. Research, Washington, D.C.*, vi, no. 23, 4th September 1916, pp. 883–888, 4 figs., 1 plate, 2 tables.

The Cecidomyiid, *Aphidoletes meridionalis*, Felt, has been observed to attack the following Aphids :—*Aphis asclepiadis*, Fitch, *A. avenae*, F., *A. cardui*, L., *A. gossypii*, Glov., *A. helianthi*, Mon., *A. maidis*, Fitch, *A. setariae*, Thos., *Chaitophorus negundinis*, Thos., *Hyalopterus pruni*, F., *Macrosiphum granarium*, Kirby, *Acyrthosiphon* (*M.*) *pisi*, Kalt., *M. sonchella*, Mon., *Myzus persicae*, Sulz., *Phorodon humuli*, Schr., *Rhopalosiphum sonchi*, Oestl., *Sipha flava*, Forbes, *Siphocoryne pastinacae*, L., and *Toxoptera graminum*, Rond. The eggs are laid in masses containing up to 12 eggs on foliage among an Aphid colony or on the back of an Aphid itself. The incubation period is about three days. Aphids are attacked during the entire larval stage, which lasts from 7 to 11 days. Pupation takes place in a cocoon attached to the leaf or on or near the surface of the ground. The length of the pupal stage varies from six to nine days. Pairing and egg-laying apparently take place at night. The duration of the adult stage in captivity was 14 days, during 10 of which eggs were deposited. In the vicinity of Lafayette, Ind., at least six generations appear annually. The winter is passed as a larva and possibly also as a pupa within the cocoon.

ANDREWS (E. A.). **Termites in the Luskerpore Valley.**—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1916, Part ii, 1916, pp. 54–72, 5 figs., 2 plates. [Received 22nd September 1916.]

Two forms of termites are met with in the Luskerpore Valley, which differ in the method of the formation of the nest. In one case a mound is formed and little injury is caused to tea plants ; in the other, the nest is underground and tea suffers considerable injury. In the second form the main nest is probably to be found at some considerable depth and auxiliary comb-cells are connected with it near the surface. Damage to tea plants by this termite almost always begins above

ground, and the path on the bush is marked by the presence of an earthen tunnel, below which the insect works. Bark-bound and dying wood is more liable to attack than healthy shoots coming from the collar or from undamaged branches. The presence of a boss of wood above the collar affords a place in which the termites can work undisturbed for some time. In the case of young and unhealthy branches, the bark beneath the earthen covering is removed, and the termites are then able to attack the sapwood. The earthen galleries may ultimately completely encircle the branch and the latter will be eaten away. Various species of ants have been found to nest in abandoned galleries. The following suggestions are made for controlling this termite :—(1) ~~Young tea should be cut back to the ground in order to avoid the formation of single-stem bushes~~. (2) Existing single-stem bushes which are badly attacked should be cut back to the collar. (3) Damaged, bark-bound, and unproductive wood should be removed. (4) Efforts should be made to prevent the insects from becoming established on the bushes; this can be done to a great extent by good cultivation and pruning.

Tour of the Entomologist.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1916, Part ii, 1916, pp. 81-82. [Received 22nd September 1916.]

The following insects were found in the Dibrugarh and Doom Dooma districts during April :—*Tetranychus bioculatus* (red spider), *Bucktonia theaecola* (tea aphis), *Homona coffearia* (tea tortrix), *Clania crameri* and *C. variegata* (faggot and bag worms), the Chrysomelid, *Diapromorpha melanopus*, *Helopeltis theivora* (tea mosquito), termites, the Psychid, *Acanthopsyche snelleni*, *Belippa* sp. and *Thosea* sp. (gelatine and nettle grubs), *Brevipalpus obovatus* (scarlet mite), *Heterusia magnifica* (red slug), *Biston suppressaria*, *Brachytrypes achatinus* (cricket), *Hemichionaspis* (*Chionaspis*) *theae* (white tea-leaf louse), *Saissetia* (*Lecanium*) *hemisphaerica*, *Psocus taprobanes*, *Amata* (*Syntomis*) *atkinsoni*, *Dasychira* (*Clene*) *mendosa* (tea tussock moth), *Empoasca flavescens*, *Tettigoniella leopardina*, and *Andraca bipunctata* (cluster caterpillar).

Insect Pests of Tea, Dadap and Albizzia.—*Qtrly. Jl. Scient. Dept. Ind. Tea Assoc., Calcutta*, 1916, Part. ii, 1916, pp. 87-88. [Received 22nd September 1916.]

The following insect pests were recorded in Ceylon during 1915 :—On tea : *Zeuzera coffeae* (red borer), *Heterusia cingala* (red slug), Lamellicorn larvae, *Natada nararia* and other nettle grubs, *Homona coffearia* (tea tortrix), *Helopeltis antonii* (tea mosquito), *Eriophyes* (*Phytoptus*) *carinatus* (purple mite), *Orgyia postica* (small tussock caterpillar), *Stauropus alternus* and various species of PSYCHIDAE.

On dadap (*Erythrina*) : *Dasychira horsfieldi* (large yellow tussock caterpillar), *Terastia meticulosalis* (dadap shoot borer) and *Anoplocnemis phasiana* (paddle-legged bug).

On *Albizzia* : *Arbela quadrinotata* and *Terias silhetana*. The latter species was also reported as defoliating *Sesbania grandiflora*.

PETCH (C. E.). **Controlling Apple Insects in the Province of Quebec.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 8, August 1916, pp. 697–698.

Observations on the occurrence and methods of control of apple pests in Quebec were made between 1912 and 1915. A preliminary survey made in 1912 showed that control by means of clean cultivation was impossible, or at least very difficult, in many districts owing to the rough character of the land. A marked increase in the practice of spraying in the two following years resulted in a diminution in the numbers of tent caterpillars [*Malacosoma*]. During 1915, demonstrations in spraying were given in several orchards, with the result that there was a marked decrease in injury due to apple curculio [*Anthonomus quadrigibbus*], bud-moth [*Eucosma ocellana*], leaf-hoppers, etc. During the present year investigations are being carried out on the biology and control of the apple maggot [*Rhagoletis pomonella*].

CAMPBELL (J. A.). **The Lime-Sulphur Spraying Compound.**—*Jl. Agric., Wellington, N.Z.*, xiii, no. 1, 20th July 1916, pp. 52–55. [Received 26th September 1916.]

Lime-sulphur possesses both insecticidal and fungicidal properties and can be satisfactorily used for both winter and summer spraying. It may be combined with lead arsenate, but this mixture should not be prepared until required, in order to avoid scorching the foliage. Home-made lime-sulphur may be prepared according to the following formula:—100 lb. sulphur, 50 lb. roche-lime (95 per cent. pure), 50 gals. water. The resulting solution usually registers from 27° to 28° Bé. A table for the dilution of the stock solution is given. The various strengths at which lime-sulphur, based on a 33° Beaumé test, is recommended for use are as follows:—In winter: for apples and pears, 1–10, applied just as the buds begin to swell; for stone fruits, 1–15, applied in autumn and again when the buds swell. In spring: for pears, 1–15 or 1–20; for apples, 1–25 or 1–30, applied when the buds show colour. In summer: for apples and pears, from 1–100 to 1–120 throughout the season, combined with lead arsenate.

ROEPKE (W.). *Scelio javanica*, **n. sp. Rpke. (Hym.: Proctotrypidae).**—*Tijdschr. Entom., The Hague*, 59th Deel, 3rd Aflevering, 15th September 1916, pp. 163–169, 5 figs.

The Proctotrupid, *Scelio javanica*, sp. n., here described, is a parasite of grasshoppers, like the other known species of the genus. It occurs in Central and East Java as an egg-parasite of *Cyrtacanthacris* (*Acridium*) *nigricornis*, Burm., and is therefore of some economic importance. It is found in abundance in the egg-masses when this grasshopper has increased sufficiently to become a pest. This occurred in Java in 1914 and 1915. One parasite develops in each egg. Usually only some of the eggs of a mass are attacked. The proportion of females to males is as 10 or 20 to 1. This species of *Scelio* was observed during a previous grasshopper invasion in 1897 and was mentioned by Koningsberger and Zimmermann, but no name or description of it was given.

ROEPKE (W.). **Zwei neue Gambir-schädliche Capsiden aus Sumatra.** [Two new Sumatran Capsid pests of *Uncaria gambir*.]—*Tijdschr. Entom., The Hague*, 59th Deel, 3rd Aflevering, 15th September 1916, pp. 180–183, 3 figs.

A description is given of *Helopeltis sumatranus*, sp. n., and *Hyalopeplus uncariae*, sp. n., both of which Capsids were found on the west coast of Sumatra attacking *Uncaria gambir*.

VELU (H.) & BOUIN (A.). **Essai de destruction du** *Schistocerca peregrina* **au Maroc par le** *Coccobacillus acridiorum* **du Dr. d'Hérelle.** [An attempt to destroy *Schistocerca peregrina* in Morocco by employing Dr. d'Hérelle's *Coccobacillus acridiorum*.]—*Ann. Inst. Pasteur, Paris*, xxx, no. 8, August 1916, pp. 389–421, 7 figs.

This paper is an amplification of one already abstracted [see this *Review*, Ser. A, iv, p. 46].

CARLES (P.). **La lutte contre la Pyrale au commencement du xix^e siècle.** [Measures against *Sparganothis* early in the nineteenth century.]—*Rev. Viticulture, Paris*, xlv, no. 1154, 10th August 1916, pp. 91–93.

In 1824 a memoir on the control of *Sparganothis pilleriana* by Maffre de Rigaud was published. Among the methods tried were the collection of the larvae, defoliation, decortication, the planting of trap-crops between the vine stocks, and painting the stocks with mixtures contained decoctions of strong-smelling plants and very old lees of olive oil. In one experiment a number of lighted torches were placed at night in the vineyard, the moths being then driven from their resting places into the flames. A great uncle of Maffre de Rigaud, Rigaud de Belbezé, was the author of a memoir on the control of this moth, which was printed in 1730.

MARCHAND (—). **Végétaux autres que la vigne dévorés par la Cochylis et l'Eudémis.** [Plants other than the vine devoured by *Clysia ambiguella* and *Polychrosis botrana*.]—*Rev. Viticulture, Paris*, xlv, no. 1154, 10th August 1916, pp. 93–94.

In France *Clysia ambiguella* is able to live on a number of other plants besides the grape vine [see this *Review*, Ser. A, iv, p. 437] such as *Ampelopsis hederacea, Euonymus europaeus, Cornus mas, C. sanguinea, Hedera helix, Ligustrum vulgare, Lonicera periclymenum, Rhamnus frangula, Viburnum opulus, V. lantana, Syringa persica, Prunus spinosa, Ribes nigrum, R. rubrum*, etc.

Polychrosis botrana has also many host-plants, including *Rosmarinus officinalis, Daphne gnidium, Clematis vitalba, Ribes grossularia*, and *Ampelopsis hederacea*.

MAISONNEUVE (P.). **A propos de l'habitat de la Cochylis.** [Concerning the habitat of *Clysia ambiguella*.]—*Rev. Viticulture, Paris*, xlv, no. 1158, 7th September 1916, pp. 159–160.

With reference to a note by M. Labergerie on the habitat of *Clysia ambiguella*, particularly juniper trees [see this *Review*, Ser. A, iv, p. 437],

it is pointed out that no mention is made of feeding having occurred on these plants. Little importance attaches to the fact of a plant providing a habitat only, but if it provides food, the matter is more important and deserves further investigation.

BALTZINGER (G.). **Recherches sur le traitement de la Cochylis.** [Investigations on the control of *Clysia ambiguella*.]—*Rev. Viticulture, Paris*, xlv, no. 1159, 14th September 1916, pp. 170-173.

In experiments made in vineyards near Geneva in June 1916, some of the plots were treated with a 3 per cent. solution of Golazine, others being left as controls. Counts of plots treated on 2nd and 23rd June showed 1 living larva to every 2·42 bunches in one case and to every 1·60 bunches in another, as compared with 1·36 bunches on the control plot. In another vineyard a plot treated on the 29th June showed about one larva on two bunches as compared with one on 1·35 bunches on the control. A count was also taken on a plot treated on the 20th May and again on the 31st May with a Bordeaux spray containing 0·3 per cent. of sodium arsenate and 0·9 per cent. of lead acetate. In this case one larva was found on two bunches and one on 1·24 bunches on the control. The cost of the Golazine treatment, including labour, was about £1 14*s.* 0*d.* per acre. It was not possible to ascertain whether oviposition occurred as frequently on the treated vines as on the untreated ones.

Die Wespe als Schützerin der Weinberge. [The wasp as a protector of vineyards.]—*Schweiz. Zeitschr. f. Obst- u. Weinbau, Frauenfeld*, xxv, no. 18, 9th September 1916, p. 294.

A note in the *Frankfurter Zeitung* points out that wasps are useful in vineyards, as their larvae are fed almost exclusively on insects, hairless grubs being preferred. In one wall-wasp nest no less than 25 larvae of the first generation of *Clysia ambiguella* were found. According to an old proverb, a good wasp year and a good vintage go hand in hand.

SCHNEIDER-ORELLI (O.). **Ueber die Selbstherstellung des Raupenleims.** [The home preparation of banding adhesive.]—*Schweiz. Zeitschr. f. Obst- u. Weinbau, Frauenfeld*, xxv, no. 20, 22nd September 1916, pp. 318-321.

The unsatisfactory results obtained with two formulae for the home preparation of an adhesive for banding purposes when subjected to tests [see this *Review*, Ser. A, iv, p. 79], induced further trials with all such formulae in the available literature on the subject. A given formula was not discarded if unsatisfactory at first, but various modifications were tested and in the case of one adhesive containing resin, stearin oil and lard, no less than 36 changes were tried. The quality of the mixtures was tested in the open, as atmospheric conditions play an important rôle in practice. While inferior samples may be effective against caterpillars, such as those of *Lymantria monacha*, they are useless in the case of the long-legged females of *Cheimatobia brumata*.

The mixture recommended by both Taschenberg and Hollrung, containing five parts resin, two parts lard, two parts stearin oil and one part Venetian turpentine, proved useless against *C. brumata*, as it became liquid on the sunny side of the tree-trunks and on the shady side formed a skin over which the females were able to crawl. Many writers, including Taschenberg and Kirchner, have recommended a mixture of five parts rape-seed oil, one part lard, one part turpentine, and one part colophony. This proved very sticky, but too liquid. Kirchner also advised a mixture of seven parts wood-tar, five parts colophony, five parts brown soap and three parts fish oil, but this is not efficacious in the case of *C. brumata* as it forms a dry skin. Contrary to what is stated in text-books, a mixture of equal parts of colophony and linseed oil is absolutely useless. Both coal-tar and the more costly wood-tar are too liquid, and soon lose their adhesiveness if mixed with resin. A mixture of six parts fir-resin, five parts stearin oil and four parts lard also proved inefficient. A home-made adhesive is therefore not advisable and where the American product is unobtainable, it is best to use the commercial black banding adhesive. This must be renewed more often than the American one.

SAVASTANO (L.). **La invasione di bruchi nei noccioleti del Messinese.** [The invasion of grubs in the hazel woods of the Messina district.] *Riv. Agricoltura, Parma*, xxii, no. 38, 22nd September 1916, pp. 582-583.

This article contains in a popular form the particulars given in one already abstracted [see this *Review*, Ser. A, iv, p. 76].

MALENOTTI (E.). **"Signiphora merceti" Malen. n. sp.**—Separate, dated 21st September 1916, from *Redia, Florence*, xii, no. 1, pp. 181-182.

Signiphora merceti, sp. n., a Chalcid bred from *Chrysomphalus dictyospermi*, Morg., in Spain, is described.

GRANDI (G.). **Nota su due Agaonini (Hymenoptera, Chalcididae) dell' Australia.** [A note on two Australian AGAONINAE.]—Separate, dated 7th September 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, pp. 145-159, 5 figs.

Blastophaga ghigii, sp. n., from the fruits of *Ficus stenocarpa*, and *Pleistodontes froggatti*, Mayr, from those of *Ficus macrophylla*, in New South Wales are recorded.

BOWES (F.). **Tea Seed Regulations.**—*Extract from Ceylon Govt. Gaz.*, no. 6,782, 3rd March 1916. [Received 20th September 1916.]

No tea seed imported from India shall be cleared locally from the Customs until the importer has produced for the inspection of the Principal Collector of Customs a certificate from the Government chemist to the effect that the imported seed is not packed in soil or a mixture containing soil.

Insect Pest and Quarantine Ordinance, No. 5 of 1901.—*Extract from Ceylon Govt. Gaz.*, no. 6,801, 16th June 1916. [Received 20th September 1916.]

Under the terms of this Ordinance, any owner or person in charge of land within the tea-growing area, as defined by the Director of Agriculture, shall eradicate and burn all plants of *Ricinus communis*, L. (castor oil plant) growing on such land, unless permission be granted by the Director. The latter shall have the right of providing for the inspection of all lands within the tea-growing area.

MATHESON (R.). **Apple Plant Lice and their Control.**—*8th Ann. Rept. Quebec Soc. for the Protection of Plants from Insects and Fungous Diseases, 1915-1916*, Quebec, 1916, pp. 24-41, 5 plates. [Received 26th September 1916.]

Overwintering eggs of *Aphis avenae*, F. (grain aphis) began to hatch during 1915 in the latitude of Ithaca, N.Y., on 13th April, *i.e.*, before the apple buds were showing green. Stem-mothers matured during the last week in April and the first week in May, when the blossoms were showing pink, and continued to reproduce until 1st June, the maximum number produced by one individual being seventy-five. Individuals of the second generation began to reach maturity on 11th May and some acquired wings. All individuals became winged by the middle of June. Return to the apple took place in September and October. Even in cases in which from 70 to 80 individuals were present on a single bud, the resultant distortion or curling of the leaves was not marked. This species is not to be regarded as a serious pest.

Eggs of *A. sorbi*, Kalt., hatched between 22nd April and 3rd May, when the buds were green. Members of this generation congregated on opening flower buds and later on the flower stalks, on leaves surrounding the flowers and on the flowers themselves. The reproductive period of the stem-mothers lasted about 33 days, from 130 to 244 young being produced. A large proportion of the second generation became winged. This generation reached maturity at the end of May and the beginning of June, and continued to reproduce throughout that month; from 70 to 162 young were produced by one individual. The third generation reached maturity between 10th and 15th June and gave rise to young until the middle of July or later; about 130 were produced by one individual. All the descendants of the third generation became winged. Four complete generations developed on the apple.

Aphis pomi, de G., hatching from overwintering eggs appeared between 21st April and 2nd May. Stem-mothers reaching maturity between 11th and 14th May continued to reproduce for at least 30 days, each individual giving rise to about 59 young. The second generation became mature in from 12 to 14 days and was largely composed of winged forms which spread the infestation throughout the orchard. Reproduction continued rapidly throughout the summer. Sexual forms appeared late in September, and after pairing, each female was capable of depositing from two to six fertile eggs.

Several experiments were carried out to determine the value of certain sprays against stem-mothers hatching from the over-wintering eggs. A spray consisting of lime-sulphur (1 to 8) and Black Leaf 40 at the rate of ¾ pt., 1 pt., and 1¼ pts. to 100 gals. of the mixture was applied on 22nd April to one side of the trees only. Examination on 1st June of one variety showed an infestation of 6·4 per cent. on the sprayed side and 28·5 per cent. on the unsprayed. A second series of experiments was undertaken on 21st April, when the following sprays were applied, the trees being thoroughly treated from both sides :—(1) lime-sulphur (1 to 8) and 1¼ pts. Black Leaf 40 in 100 gals ; (2) 15 lb. whale oil soap, 1 lb. carbolic acid, 100 gals. water. Examination on 19th May showed that the first spray gave almost complete control, while the second was less effective. Carbolic acid at the rate of ½ oz. in 1 gal. water or lime-sulphur (1–40) had no effect on the Aphids, but caused the death of the shoot. The addition of carbolic acid to the soap solution does not appear to increase its insecticidal value.

CHAPAIS (J. C.). **The Chrysopa or Golden-Eyed Fly.**—*8th Ann. Rept. Quebec Soc. for the Protection of Plants from Insects and Fungous Diseases, 1915–1916.* Quebec, 1916, pp. 50–51, 1 fig. [Received 26th September 1916.]

About 12 species of the genus *Chrysopa* are known in Quebec. The eggs are stalked and attached to leaves or twigs. The incubation period is seven days. The larvae are predaceous on Aphids, the larvae of *Chermes* and of curculios. Maturity is reached in 12 days, a cocoon being formed for pupation. The duration of the pupal stage is 16 days.

DU PORTE (E. M.). **Insect Notes, 1915.**—*8th Ann. Rept. Quebec Soc. for the Protection of Plants from Insects and Fungous Diseases, 1915–1916*, Quebec, 1916, pp. 73–77, 1 plate. [Received 26th September 1916.]

Cereals and clover were attacked by the following insects:—*Oscinella (Oscinis) carbonaria* (frit fly), *Meromyza americana* (wheat stem maggot), and *Mayetiola destructor* (Hessian fly) on small grains; *Bruchophagus funebris* (clover seed Chalcid), *Hypera (Phytonomus) nigrirostris* (lesser leaf weevil), *Bryobia pratensis* (clover mite), *Acyrthosiphon (Macrosiphum) pisi* (pea aphis), and *Tychius picirostris* (clover-head weevil). The last-named was abundant on the leaves of red clover during May and continued to feed until September. Hibernation took place in the adult stage in lumps of manure and vegetable matter beneath the surface of the soil.

Grain, hay, root-crops and garden plants were injured by *Melanoplus atlantis* (lesser migratory locust), *M. femur-rubrum* (striped locust) and *M. bivittatus* (striped locust). Insects injurious to field and garden crops included:—*Euxoa tessellata* (cutworm); *Chortophila brassicae* (cabbage root maggot) and *C. fusciceps* (seed corn maggot) on cruciferous crops; *C. vicina* (beet-leaf miner) on mangels, beets and spinach; *Psila rosae* (carrot rust fly) on carrots; *Psylliodes punctulata* (hop flea-beetle) on beet and mangel; *Depressaria heracleana* (parsnip web-worm) on parsnip.

Insects attacking fruit were *Eucosma ocellana* (bud moth) on apple, apple maggot [*Rhagoletis pomonella*], buffalo tree-hopper [*Ceresa bubalus*], currant and raspberry sawflies and the imported currant borer [*Aegeria tipuliformis*]. *Eriocampoides limacina* (plum slug) caused little damage owing to effective parasitism by the Chalcid, *Trichogramma* (*Pentarthron*) *minutum*.

GOODERHAM (C. B.). **Three Injurious Acridians of Nova Scotia.**—*8th Ann. Rept. Quebec Soc. for the Protection of Plants from Insects and Fungous Diseases, 1915–1916*, Quebec, 1916, pp. 89–91. [Received 26th September 1916.]

The three injurious grasshoppers dealt with are *Melanoplus atlantis*, Riley, *M. femur-rubrum*, de G., and *Camnula pellucida*, Scud. Notes on the life-histories, with a key to the identification of the species, are given.

LOCHHEAD (W.). **Insect Pests of Cereal Crops of Quebec.**—*8th Ann. Rept. Quebec Soc. for the Protection of Plants from Insects and Fungous Diseases, 1915–1916*, Quebec, 1916, pp. 101–115, 11 figs. [Received 26th September 1916.]

The following insects injurious to cereal crops in Quebec are recorded: *Mayetiola destructor* (Hessian fly), on wheat, rye and barley; *Isosoma tritici* (wheat joint worm); *Meromyza americana* (wheat bulb-worm); *Contarinia* (*Diplosis*) *tritici* (wheat midge); several species of locusts; Aphids, including *Macrosiphum granarium* (*Nectarophora cerealis*); army-worms; the wireworms, *Melanotus cribulosus*, *Agriotes mancus* and *Drasterius elegans*; white grubs, including *Lachnosterna arcuata* and *L. rugosa*.

A key is given to the identification of the various insects attacking the roots, the stems and leaves, and the ears of cereals.

FRANKLIN (H. J.). **Report of Cranberry Substation for 1915.**—*Massachusetts Agric. Expt. Sta., Amherst*, Bull. no. 168, May 1916, 48 pp., 19 tables. [Received 29th September 1916.]

Injury to cranberries by the Tortricid, *Rhopobota vacciniana*, Pack. (black-head fireworm), was similar in extent to that occurring in previous years. Efforts to control this insect by retaining the winter flooding late enough to kill the eggs appeared to be successful; in two cases the water was held until the middle of June and 1st July respectively, with the result that the numbers of the insect showed a marked decrease and the plants were not apparently injured. The Pyralid, *Mineola vaccinii*, Riley (cranberry fruit worm), showed an increased abundance as compared with 1913 and 1914. Cocoons submerged for the period between 15th January and 31st March were able to survive to an extent of 40 per cent.; submergence until 20th May was fatal to 100 per cent. The conclusion is therefore reached that infestation by *M. vaccinii* occurring in bogs in which winter flooding is retained late, originates in the upland and not in the bog

itself. The degree of parasitism during the year was high. The Braconid, *Phanerotoma tibialis* parasitised from 27 to 72 per cent. of the larvae on dry bogs and from 0 to 22 per cent. on bogs with late winter flooding. The Ichneumonid, *Pristomeridia agilis*, varied from 5 to 38 per cent. on dry bogs and from 0 to 7½ per cent. on those with late flooding. The Chalcid, *Trichogramma minutum*, varied from 42 to 89 per cent. and from 12 to 89 per cent. under the same conditions. Pupation on the part of *M. vaccinii* and of *P. tibialis* and *P. agilis* was found to take place during the first half of June. *P. agilis* deposited one or two eggs in the host larva. *P. tibialis* was found to be oviparous. The incubation period was not more than four days. Pupae of *M. vaccinii* were also found to contain *Megastigmus brevicaudis*, Ratz., and *Syntomaspis* sp.; these may have been primary or secondary parasites. Larvae of *M. vaccinii* kept under observation fed on the following fruits:—*Vaccinium corymbosum*, L., *Gaylussacia frondosa*, L., *G. baccata*, Wang., *Pyrus malus*, L., *Prunus maritima*, Wang., *P. serotina*, Ehrh., and *Viburnum cassinoides*, L. *Cirphis* (*Heliophila*) *unipuncta*, Haw. (army worm), and the tent caterpillars, *Malacosoma disstria*, Hb., and *M. americana*, F., were rarely seen. The Geometrid, *Abbotana clemataria*, S. & A., a species commonly occurring in cranberry bogs in July, was kept under observation. Pupae formed between 9th and 25th July, 1914 gave rise to adults between 20th and 27th May 1915. One female deposited 432 eggs about 30th May. Larvae emerged on 14th June and when mature, pupated in sand at a depth of 2 inches. The following Geometrids have also been reared:—*Cymatophora sulphurea*, Pack., *Epelis truncataria* var. *faxonii*, Minot, *Cingilia catenaria*, Drury, and *Cleora pampinaria*, Gn. The Ichneumon, *Amblyteles putus*, Cress., was reared from *C. sulphurea*.

The Chrysomelid, *Rhabdopterus picipes*, Ol. (cranberry root-worm) caused some injury in one locality in a bog which had been flowed every winter to a depth of 9 inches. Hibernation was found to take place in the sand at depths varying from 1½ to 8 inches. Another Chrysomelid, *Cryptocephalus incertus*, Ol., attacked the foliage in one district, infestation being first noted on 20th August and continuing until the middle of September. *Lepidosaphes ulmi*, L. (oyster-shell scale) was met with in varying numbers, but was never abundant on flowed bogs. Infestation by *Lymantria* (*Porthetria*) *dispar*, L. (gipsy moth) can apparently take place in the following ways: (1) by hatching of eggs deposited on the bog during the previous year; (2) by transportation by the wind of young larvae; (3) by larvae falling on to the margins of the bog from overhanging trees; (4) by the migration of larvae in the later stages across marginal ditches. Injury by *Perrisia vaccinii* (*Cecidomyia oxycoccana*, Joh.) (cranberry tip worm), showed a marked decrease in those bogs which had been resanded between September 1914 and May 1915.

GOSSARD (H. A.). **The Clover Leaf Tyer** (*Ancylis angulifasciana*, **Zeller**).—*Ohio Agric Expt. Sta., Wooster*, Bull. no. 297, May 1916, pp. 429–443, 3 plates. [Received 30th September 1916.]

Much of the information in this paper has already been given in a previous abstract [see this *Review*, Ser. A, iv, p. 188]. Severe damage

to clover by *Ancylis angulifasciana* has occurred in Ohio only at Wooster. Red and alsike clovers are most seriously injured, while *Trifolium repens* (white clover) suffers less. Probably all species belonging to the genus *Trifolium* may serve as food-plants.

MARCHAL (P.). **Les Sciences Biologiques Appliquées à l'Agriculture et la lutte contre les enemis des plantes aux Etats-Unis.** [The biological sciences applied to agriculture and the struggle against plant pests in the United States.]—*Ann. Service des Epiphyties, Paris*, iii, 1916, pp. 31–390, 120 figs., 1 map. [Received 19th September 1916.]

This is a report on a three months' journey in the United States made on the initiation of Dr. L. O. Howard, the expenses of which were defrayed by Mr. A. Carnegie. The itinerary outwards was from Boston to San Francisco and homewards through Los Angeles, Arizona, New Mexico, Kansas and Texas to New Orleans, thence through the eastern States to New York and Boston, the various agricultural stations being visited en route. After a general survey of the relations between applied science and agriculture in the United States and an account of the U.S. Department of Agriculture, and its publications, the Bureau of Entomology and its staff and work are described, with details as to the methods used in special investigations, abundantly illustrated by photographs. A description of the research work in progress at the time of the visit is given, with a survey in considerable detail of the more important investigations and the results obtained. The Bureaus of Plant and Animal Industry are fully dealt with. The general organisation of the State Agricultural Experiment Stations is given, with a statement of the special work which has been done by some of them. The work of the State Commission of Horticulture and the Quarantine Division of California and that of the Massachusetts Forest Service is noticed, and the organisation of the control of the gipsy and brown-tail moths appears to have greatly impressed the author. A chapter is devoted to the organisation of the Universities of the United States, more particularly in relation to the scientific work undertaken bearing upon entomology. The Agricultural Colleges and Associations and Societies interested in kindred matters are briefly noticed. Some 70 pages are devoted to an account of the general methods employed for the study and control of insect pests of man, animals and agriculture, illustrated by some important examples; the preparation and mode of use for various purposes of Bordeaux mixture and lime-sulphur and other insecticides, poisoned baits and methods of soil disinfection are described and the methods of fumigation with hydrocyanic acid and the apparatus used receive special mention. The report concludes with a short account of the Plant Quarantine Act and its administration by the Federal Horticultural Board and of the good effect of the "Insecticide Act" and the State Legislation which has resulted from it. In a final chapter the author expresses his admiration of the organisation of the U.S. Department of Agriculture and, whilst recognising that the great size of the country demands special measures, he considers that there is much in it which might be imitated in the smaller areas of Europe.

MARCHAL (P.) & PRILLIEUX (E.). **Rapport phytopathologique pour l'année 1914.** [Report on phytopathology for the year 1914.]—*Ann. Service des Epiphyties, Paris,* iii, 1916, pp. 1-30. [Received 19th September 1916.]

The Director reports that, in spite of the War, the services of the station were carried on throughout the year 1914. It was found desirable to address a circular to export nurserymen drawing attention to the fact that three times during the winter of 1913-14 the nests of *Euproctis (Liparis) chrysorrhoea* (brown-tail moth) had been found in the U.S.A. on trees imported from France, and urging the greatest care in preventing recurrence. Rewards to workmen engaged in packing trees for export has been found the best method of providing against nests being sent with the trees. The inspection on the Italian frontier at Ventimiglia has been working since 15th November 1913 and jasmine seriously infested with *Aulacaspis pentagona* was intercepted. *Cephus pygmaeus* is reported to have done much damage near Orleans at the end of July and the stubbles were found to contain numbers of larvae near the roots. *Mayetiola avenae* did damage near Vienne, one of the first places in which it was reported. *Chlorops* was abundant in the valley of the Loire. *Colaspidema atrum,* though less abundant than usual, did a good deal of damage; in the Haute-Garonne it was exceptionally late, not becoming serious till the end of June; cyanamide applied in June gave good results against it. The larvae of *Tipula* spp. caused serious injury to pastures and forage crops in some of the northern Departments. In the Aisne the beet crops suffered seriously from the attack of *Atomaria linearis* and round Orleans from wireworms. Artichokes near Perpignan were seriously attacked by *Agromyza abiens* and the crop greatly reduced in consequence. This pest has also been found on cardoons near Montpellier. The same artichoke-growing areas suffered much from *Depressaria subpropinquella* var. *rodochrella,* H.S., pupation of which occurred in the first half of April. The market-gardens in the South suffered as usual from *Gryllotalpa gryllotalpa (vulgaris),* but the injection of carbon bisulphide into the soil at the rate of about 300 lb. per acre gave excellent results. In the Department of Loiret long wood battens are laid along the borders of the vegetable plots between holes in the ground filled with water; the insects collect under the wood in the night time, fall into the water and are drowned. The buds of beans and of a number of market-garden and ornamental plants near Perpignan were seriously injured by the Tortricid, *Cnephasia wahlbomiana,* L.; this insect has been reported on flax in Holland, on hops in Bavaria, and on strawberries in Sweden, but this is the first occasion on which it has been recorded as a pest in France. The celery fly, *Acidia heraclei,* did much damage in the Gers, and *Kakothrips (Frankliniella) robustus* injured peas, though as it appeared late, the first sowings gave a normal crop. *Anthonomus pomorum* and *A. pyri* did much damage in the apple and pear-growing districts, as also did *Hyponomeuta padellus* and *H. malinellus.* Great quantities of the caterpillars were found, chiefly on black- and white-thorn. As the adults which emerge at the end of June may oviposit on trees cultivated for export in adjoining nurseries, special measures have been ordered to clear the hedges of caterpillars, though these are not carried out as they should be. *Euproctis chrysorrhoea* and *Lymantria dispar* were generally scarce and no invasion worth recording

(C327) Wt.P1/106. 1,500. 12.16. B.&F.Ltd. G.11/3. A

was reported. In some departments the larvae of *Cheimatobia brumata* and of *Olethreutes* (*Penthina*) *variegana* and *O.* (*P.*) *pruniana* defoliated fruit trees, cherries suffering very seriously.

Apples were attacked by *Cheimatobia brumata* and by *Cydia pomonella* (*Carpocapsa pomonana*), while *Contarinia* (*Diplosis*) *pyrivora* did serious damage to pears in certain western Departments. In nearly all the apple-growing areas *Eriosoma lanigerum* was specially abundant. In the Côte d'Or, raspberries were severely attacked by *Anthonomus rubi*, which destroyed the young shoots in large numbers.

Among vineyard pests, *Polychrosis botrana* has been discovered for the first time in Champagne. In Burgundy and the Beaujolais both *P. botrana* and *Clysia ambiguella* were less abundant than in 1913; the first generation of larvae however did serious damage. In the valley of the Loire, the great quantity of pupae found under the bark in winter caused anxiety, as did also the great number of moths in spring, but the vintage, despite damage by the first generation of larvae, chiefly in the white wine producing areas, was not unsatisfactory. The methods employed for control are briefly referred to. In the Aude *Sparganothis* (*Oenophthira*) *pilleriana* was widely spread and the hot water treatment has proved successful in the Pyrénées-Orientales. This pest is increasing in the south-west in localities where a few years ago it hardly existed. In Champagne and Beaujolais, hot water treatment of the vine stakes has sensibly diminished the numbers of this Pyralid. Some growers in the Rhône are inclined to replace the hot water treatment in winter by arsenicals in spring, as being very much cheaper. The larvae of *Arctia* (*Chelonia*) *caja* were specially numerous in spring in the Gard and hand collection had to be resorted to. The belief of many vineyard owners that *Haltica ampelophaga* would disappear or be greatly diminished after a hard winter was found to be erroneous in the Departments of the Rhône, Loire and Saône-et-Loire, where this flea-beetle appeared in thousands in spring. In those areas where cupro-arsenical sprays are in general use the damage by *H. ampelophaga* is notably diminished. The larvae of *Vesperus xatarti* were fully controlled in the Var by sulphuration of the soil. A few centres of *Malacosoma lusitanica* were discovered in the Gironde. *Phylloxera* has made progress in Champagne and infected areas were discovered all over the vineyards of the Marne. In the Ile d'Oleron a company, formed for the purpose, collected 2 cwt. of *Otiorrhynchus sulcatus* between 15th May and 1st July 1914.

Nurseries of forest trees and young plantations have suffered so severely from the attack of *Rhyacionia* (*Evetria*) *buoliana* that export to the U.S.A. has been interfered with in consequence of the protective measures established there. Limes in many districts were severely injured by *Tetranychus telarius*. The fruit fly, *Ceratitis capitata*, was found in the Hérault and also in the Pyrénées-Orientales; this fly has probably been present for a long time in the south and has only just begun to be noticed as a pest. Careful search for *Aulacaspis pentagona* failed to reveal it, even near Grasse, where large plantations occur of jasmine on Italian stocks and it might have been expected. Carnations grown for market in the Alpes-Maritimes have suffered seriously from the attack of *Tortrix pronubana*. A serious invasion of *Calliptamus* (*Caloptenus*) *italicus* is recorded in South Corsica. Outbreaks of grasshoppers in the Gard and Bouches-du-Rhône were easily controlled by sprays of heavy oil or by fire.

EALAND (C. A.). **Insect Enemies.**—*London*, Grant Richards, Ltd. 1916. xiii + 223 pp., 53 figs., 8vo. [Price 6s. net.]

This book is devoted to British injurious insects and surveys the more important pests of forestry, agriculture and horticulture, as well as those of domestic animals and of stored products, with a chapter on insects which are specially injurious to man himself. The introduction, which contains a large amount of useful information, including an outline of the orders of insects, should do something to diminish the general apathy with which the subject of economic entomology is regarded by the public About 20 pages are given to each group of pests, a few well chosen examples being selected in each case for illustration. An appendix deals briefly with the methods of using various insecticides, and a bibliography, arranged according to the natural orders of insects, gives a list of more or less readily accessible works to be consulted by those desiring further information. The index shows that some 200 pests are mentioned in the book, a large proportion of which are dealt with in the text at sufficient length to give the reader substantial information as to their habits and life-history, the nature of the damage caused by them and brief practical indications as to how they may be best dealt with. This book will be found exceedingly readable even by the uninitiated, and the fact of its publication may, it is hoped, be taken as some evidence of growing public interest in a subject which so intimately concerns the welfare of mankind.

STOREY (G.). **Simon's Hot-Air Machine for the Treatment of Cotton Seed against Pink Boll Worm.**—*Minist. Agric., Cairo*, Tech. & Scient. Service, Bull. no. 11 (Entom. Sect.), 25th June 1916, 10 pp. [Received 2nd October 1916.]

A machine designed for drying malt was tested for its suitability in treating cotton seed against the pink bollworm (*Gelechia gossypiella*) [see also this *Review*, Ser. A, iv, p. 472]. The machine is described and details of the experiments are given in three tables. The optimum temperature for this machine seems to lie between 131° and 133° F., but at all the temperatures tested, a small percentage of larvae appear to succeed in surviving the treatment, and a small percentage of seed is damaged. As it is scarcely practicable, at present, to destroy by any method more than 98% of the larvae left in the bolls in the fields, if this percentage can be eliminated by this machine, it should be sufficient for practical purposes, except when the seed is to be exported to a cotton-growing country where *G. gossypiella* does not yet occur. With regard to the seed, a loss in germination of 5% is of little importance in view of the method of sowing adopted by the native cultivator in Egypt, and in commercial seed is of no importance whatever. The machine in its present state gives the above results and therefore seems to fulfil all practical requirements, though some minor improvements may be made in it. Its initial cost in Egypt, exclusive of the engine and other accessories, is between £205 and £256. No extra labour is involved, the seed being sacked as it comes from the machine instead of from the gins. It is compact, easy to manage, continuous in action and entirely devoid of danger. Its output is 76 bushels an hour.

CECCONI (G.). **Manuale di Entomologia Forestale.** [Manual of Forest Entomology.]—*Florence*, 1916, Fasc. 4, 64 pp., 72 figs.

The fourth part of this book [see this *Review*, Ser. A, iv, p. 117] covering pp. 193 to 256, completes the Rhynchota and begins to deal with the Coleopterous pests.

FEYTAUD (J.). **Les Cochenilles de la Vigne.** [The Coccids of the Vine.] *Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, nos. 1-8, January-August 1916; pp. 1-11, 21-27, 43-46, 52-54, 65-71, 88-90, 9 figs. [Received 14th October 1916.]

Many scale-insects live on the vine, either normally or through some accidental cause. In his work on the COCCIDAE of Europe and North Africa, Lindinger records — *Lepidosaphes ulmi*, L., *Aulacaspis* (*Diaspis*) *pentagona*, Targ., *Parlatoria oleae*, Colv., *Aspidiotus rapax*, Comst., *A. labiatarum*, March., *Chrysomphalus aurantii*, Mask., *Targionia vitis*, Sign., *Guerinia* (*Gueriniella*) *serratulae*, F., *Icerya purchasi*, Mask., *Phenacoccus aceris*, Sign., *Pseudococcus citri*, Risso, *P. adonidum*, L., *Rhizoecus* (*Ripersia*) *falcifer*, Künck., *Ceroplastes rusci*, L., *Saissetia* (*Lecanium*) *oleae*, Bern., *Eulecanium* (*L.*) *corni*, Bouché, *E.* (*L.*) *persicae*, F., *Physokermes coryli*, L., *Pulvinaria betulae*, L., *Pseudococcus* (*Dactylopius*) *vitis*, Nied., and *Pulvinaria vitis*, L. In France the vine is chiefly infested by four species viz: *Pulvinaria vitis*, *Eulecanium persicae*, *Targionia vitis* and *Pseudococcus vitis*. The enemies of these Coccids include birds and insects. Earwigs destroy the eggs and larvae of *E. persicae* and probably also those of *Pulvinaria vitis*. *Coccinella septempunctata*, L., *Chilocorus renipustulatus*, Scr., *C. bipustulatus*, L., and *Exochomus quadripustulatus*, L., are the Coccinellids of most interest to French growers. The Noctuid, *Eublemma* (*Coccidiphaga*) *scitula*, Ramb., does good work against *Ceroplastes rusci* and *S. oleae*. The larvae of *Chrysopa vulgaris*, Wesm., feed on young individuals of *E. persicae* in summer and autumn. The Crabronid, *Spilomena troglodytes*, Lind., is an important enemy of *Pulvinaria vitis*, L., the larvae of which are stored in its nest.

Chalcidoid enemies include:—Encyrtids — *Ericydnus ventralis*, Dalm., *Blastothrix schoenherri*, Dalm., *B. sericea*, Dalm., *Aphycus punctipes*, Dalm., *Encyrtus duplicatus*, Nees, *Eucomys swederi*, Dalm., *Chiloneurus elegans*, Dalm., *Cerapterocerus mirabilis*, Westw., and *Scutellista cyanea*, Motsh.; Pteromalids—*Eunotus cretaceus*, Walk., and *Pachyneuron coccorum*, L.; Eulophids—*Eulophus scutellaris*, Nees, and *Aphelinus scutellaris*, Dalm. The larvae of *Leucopis annulipes*, Zett., feed on the eggs of *Pulvinaria vitis*. A bibliography of 27 works completes this useful compilation.

FEYTAUD (J.). **Recherches sur les pièges-appâts: II. L'inégalité des prises.—Les captures exceptionelles.** [Investigations on bait-traps; II. The irregularity of the catches.—Exceptional catches.] —*Bull. Soc. Etude Vulg. Zool. Agric., Bordeaux*, xv, no. 8, August 1916, pp. 81-85.

The first part of this paper has already been abstracted [see this *Review*, Ser. A, iv, p. 309]. The irregularity in bait-trap catches is

due, not only to the number of moths present, but chiefly to atmospheric conditions. Cool, windy weather is unfavourable, as it keeps the moths from flying any distance, reduces the evaporation of the trap-liquid and interferes with the regular stream of odours from it. Traps placed along paths at the end of a row of stocks, or in sheltered spots, give better results than others. In certain instances an exceedingly large catch is made by one trap and the disproportion between it and the catches of adjacent traps is too great to be due to chance, nor can it be attributed to any specific difference in the successful trap. Such exceptional catches are believed to be due to a biological phenomenon connected with sex attraction. It is well known that the females of many insects, particularly Lepidoptera, attract the males from afar, and when an examination of traps with exceptional catches was made, it was found that the most typical cases occurred towards the end of the flight period, when unmated females were rare, and that exceptional catches always included one of these females, together with a very high proportion of males. In one case, 54 males, 2 females which had deposited nearly all their eggs and 1 unmated female, were found in one trap.

Les Correspondants du Service des Epiphyties. [The correspondents of the French Plant Protection Service.]—*Bull. Soc. Etude Vulg. Zool. Agric, Bordeaux*, xv, no. 8, August 1916, pp. 90–92.

Acting on a report made by M. Roux, Director of Sanitary and Scientific Services, the French Minister of Agriculture has published an order instituting correspondents of the French Plant Protection service. These correspondents, who will not be paid, are to be chosen from amongst agriculturists and other persons interested in agricultural matters. They will report to the district plant inspection officer and in cases where he receives from them specimens of pests of importance, he will forward these to the proper research station. By this means a pest will be reported as soon as noticed, so that measures may be taken against it without delay.

Sijazov (A.). **Къ біологіи нѣкоторыхъ вредныхъ насѣкомыхъ Туркестана.** [On the biology of some insect pests of Turkestan —**«Туркестанское Сельское Хозяйство.»** [*Agriculture of Turkestan*], *Tashkent*, xi, no. 4, April & May 1916, pp. 296–392 (first part). [Received 26th September 1916.]

Melasoma populi, L., is not usually a dangerous pest, but in cases of large outbreaks, it seriously defoliates poplar trees. Such an outbreak occurred in 1915, when both the beetles and their larvae did great damage to poplars. The hibernating beetles usually appear towards the end of March, the eggs being laid in large heaps, and the whole development from egg to imago lasting one month. Spraying with Paris green is suggested against this beetle, if the expense is justified.

The hibernating larvae of *Polydrosus dohrni*, Fst., are found in the middle of March in the soil underneath apple, pear and cherry trees, at a depth of 7–14 inches; they are distinguished from those of *Rhynchites auratus*, found also under cherry trees, by their narrow bodies

and large heads; the larvae pupate in spring, the first pupae having been found on 26th March, and the first adult weevils on 15th April, the time of the development of the pupa is two weeks. The eggs are usually laid in the calices of apples, though in some cases in the laboratory they were found on leaves of apple and pear, on which the adults feed. The damage done by this weevil is not very serious, unless it is present in large numbers. The use of tanglefoot belts is advised against it. The adults of *P. obliquatus*, Faust, appear simultaneously with those of *P. dohrni*. In the laboratory they feed on leaves of apple and pear, on the lower side of which they oviposit.

AVERIN (V. G.). **Состояніе сельско-хозяйственныхъ культуръ въ отношеніи вредителей по даннымъ Энтомологическаго Бюро и по сообщеніямъ корреспондентовъ.** [A statement as to the pests of cultivated plants based on the records of the Entomological Bureau and reports of correspondents.]—**« Бюллетень о вредителяхъ Сельскаго Хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletin on the Pests of Agriculture and Methods of Control*]. Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 7, July-December 1915, pp. 35-38. [Received 9th October 1916.]

This is a continuation of a series of periodical reports [see this *Review*, Ser. A, iii, p. 539 and iv., p. 137]. During the period from June to October the following pests were reported:—In orchards: *Rhynchites pauxillus*, Germ.; *Hyponomeuta malinellus*, Z., in enormous numbers; *Aporia crataegi*, L., the second generation being present in large numbers; *Cydia pomonella*, L., *Eriophyes* (*Phytoptus*) *pyri*, L., *Eriocampoides limacina*, L., *Aphis pomi*, de G., *Myzus cerasi*, F., *Hyalopterus pruni*, F., *Chaitophorus ribis*, L., very numerous on red currants, and *Psylla mali*. In market-gardens: *Gryllotalpa gryllotalpa*, L., *Aphis rumicis*, L., (*papaveris* F); *Aphis gossypii*, on melons, cucumbers and squashes; *Aphis brassicae*, L.; *Barathra* (*Mamestra*) *brassicae*, L., particularly injurious to cabbages and beet.

In fields: *Anisoplia austriaca*, Herbst; *Ophonus calceatus*, Duft.; *Cephus pygmaeus*, L.; *Mayetiola* (*Cecidomyia*) *destructor*, Say; *Macrosiphum granarium*, Kirby (*cerealis*, Kalt); *Deltocephalus striatus*.

In stores and warehouses: *Calandra granaria*, L., and *Tenebrio molitor*, L. In forests: *Earias chlorana*, the caterpillars of which attacked willow plantations in one locality.

AVERIN (V. G.). **Массовое появленіе озимой совки осенью 1915 г. въ Харьковской губерніи.** [An outbreak of *Euxoa segetum*, Schiff., in the autumn of 1915 in the govt. of Charkov]—**« Бюллетень о вредителяхъ Сельскаго Хозяйства и мѣрахъ борьбы съ ними.»** [*Bulletin on Pests of Agriculture and their Control*]. Published by the Entomological and Phytopathological Bureau of the Zemstvo of the govt. of Charkov, *Charkov*, no. 7, July-December 1915, pp. 38-49. [Received 9th October 1916.]

A large outbreak of the caterpillars of *Euxoa* (*Agrotis*) *segetum*, Schiff., occurred in the government of Charkov, in the autumn of 1915.

Great damage was done in many localities, the whole of the crop of rye and to a less degree of winter-sown wheat being destroyed in many cases.

In some fields, when the crop had been destroyed, the caterpillars afterwards attacked certain weeds, especially thistles. Late-sown rye and winter wheat suffered less.

BALABANOV (M.). **Къ вопросу о борьбѣ съ яблоннымъ цвѣтоѣдомъ.** [On the question of the control of *Anthonomus pomorum.*] — **« Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxvii, no. 8-9, August-September 1916, pp. 366-370.

Anthonomus pomorum is not only one of the most dangerous pests of orchards, but also most difficult to control. The majority of the remedies usually recommended against the adults and the larvae are of limited practical value. Belts of adhesive paper placed on the trees in April, although instrumental in intercepting a considerable number of the weevils, mostly the females before oviposition, are far from being a complete remedy, as enormous numbers fly from tree to tree. In years when the soil in August and September is wet, good results have been obtained by using belts made of chopped reeds and straw, as apparently in wet years the weevils do not hibernate in the soil if they can find shelter in drier spots. Smearing the trunks and branches with milk of lime is regarded as a reliable preventive, if properly prepared and applied, but this is only a partial protection, as the weevils also hibernate on forest trees. Spraying in April with lime or with crude carbolic acid ($\frac{1}{2}$-2 lb. of the acid in 3 gals. of water), is only a temporary deterrent, and it is only when this is carried out during the short period of oviposition and repeated after a day or two, that oviposition may be delayed and the buds allowed to unfold before being attacked by the larvae.

S. V. **О замѣнѣ квассія табакомъ.** [On the replacement of quassia by tobacco.] — **« Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxvii, no. 8-9, August-September 1916, pp. 378-379.

As a substitute for quassia decoction and soap, tobacco and soap may be used, 1 lb. tobacco leaves being boiled in 3 gallons of water to which $\frac{1}{2}$ lb. of soap is subsequently added. After describing the process of preparing tobacco extract [see this *Review*, Ser. A, iv. p. 380], it is stated that it may be preserved by adding 1 gram of salicylic acid to each pint. For use, 5-10 lb. of the extract is dissolved in 30 gallons of water, 5 lb. of soap being added.

GOLITZYN (S.). **Результатъ прошлогодней борьбы съ медяницей окуриванiемъ сада.** [The result of last year's attempt to control *Psylla* by means of fumigation.] — **« Плодоводство.»** [*Fruit-Growing*], *Petrograd*, xxvii, no. 8-9, August-September 1916, p. 380.

Further details are given on the experimental fumigation of orchards against *Psylla mali*, [see this *Review*, Ser. A, iv. p. 168]. In one of the orchards fumigated the previous year, the pest was present in very

small numbers; in a second, large numbers occurred on neighbouring elms; and in a third, the total destruction of the insect was prevented by the presence of long grass in which the stupified insects recovered and survived. It is therefore recommended that:—An orchard be fumigated in addition along its edges, especially if it is surrounded by trees; each fumigating heap should contain not less than 5 lb. of tobacco dust and 10 lb. of straw, the lines of heaps being not more than about 23 yards apart; they must be carefully watched and stirred until completely consumed; the grass in the orchard should be cut as early as possible.

Ol (I. A.). **Поврежденіе листьевъ розъ насѣкомыми.** [Insects injuring leaves of roses.]—**« Прогрессивное Садоводство и Огородничество. »** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 36, 17th September 1916, p. 844.

Eriocampoides aethiops, F., attacks the leaves of roses from the end of May till the first half of July. The larvae remain in a cocoon in the soil during the latter part of the summer, the autumn and winter, pupating early in spring and producing the imago in May. The remedies are: spraying with arsenate of lead or calcium arsenite in May, and the cultivation of the soil beneath the bushes in autumn or early in spring.

Peressypkin (P.). **Вредители оранжерейныхъ и тепличныхъ культуръ въ сѣверныхъ и среднихъ губерніяхъ Россіи на персикахъ и абрикосахъ.** [Pests of green-house and hot-house cultivation in North and Central Russia—peaches and apricots.]—**« Прогрессивное Садоводство и Огородничество. »** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 38, 1st October 1916, pp. 883–885.

A short account of the life-history of scale-insects is given, with some remedies against them. In orchards the best results are obtained by spraying with a mixture of lime, crude carbolic acid and iron sulphate; in nurseries the same spray may be used, but somewhat weaker, viz:—1 lb. of iron sulphate, 4 lb. of freshly slaked lime, a quarter of a pint of carbolic acid and the same quantity of molasses in 3 gallons of water. The spray must be repeated early in spring before the unfolding of the buds. Hot-houses may be disinfected with a solution containing 3-5 lb. of iron sulphate and a quarter of a pint of carbolic acid in 3 gallons of water.

Ol (I. A.). **Мѣры борьбы съ луговымъ мотылькомъ на огородѣ.** [The control of *Phlyctaenodes sticticalis*, L. in market-gardens.]—**« Прогрессивное Садоводство и Огородничество. »** [*Progressive Fruit-Growing and Market-Gardening*], *Petrograd*, xiii, no. 38, 1st October 1916, p. 892.

The control of *Phlyctaenodes sticticalis* in market gardens comprises (1) spraying the attacked plants with barium chloride, Paris green, lead arsenate, or calcium arsenite; (2) handpicking, if the number of the caterpillars is not great; (3) spraying the caterpillars themselves with kerosene or carbolic emulsion; (4) cultivation of the soil in autumn and early spring to destroy the caterpillars wintering in cocoons.

Oshanin (V.). **Указатель литературы, необходимой при опредѣленіи Полужесткокрылыхъ.** [Index of literature for the determination of Hemiptera.]—**«Труды Русскаго Энтомологическаго Общества.»** [*Horae Societatis Entomologicae Rossicae*], *Petrograd*, 1916, xlii, no. 2, 106 + v pp.

This bibliography of the Rhynchota contains 1,184 entries, the preface and the author's remarks being in French.

Работы по борьбѣ съ вредителями лѣса въ 1915 г. по лѣсничествамъ Тамбовской губерніи. [The control of pests of forests in the forestries of the govt. of Tambov in 1915.]—**«Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*], *Tambov*, v, no. 2, 1916, pp. 8-12.

The insect pests in the forests of the government of Tambov [see also this *Review*, Ser. A, ii, p. 331 and A. iii, p. 728] for the year under report included *Rhyacionia* (*Retinia*) *buoliana* and *Lophyrus pini*, attacking young plantations less than 13 years old. The control measure adopted consisted in handpicking, 216,000 individuals of *R. buoliana* and 460,000 of *L. pini* being collected, at a total cost of of about £9 or 6½d. per acre. In other forest districts the only pests present were the larvae of *Melolontha*, the numbers of which show a decrease in recent years. Handpicking the larvae, digging trenches round the nurseries to a depth of about 21 inches and, in one locality, ploughing the spaces between the lines of trees during the growing period, when the larvae are near the surface, were carried out. The last remedy, when applied on sandy soil, reduced the number of larvae by 22 per cent. and in black soil by 12 per cent. In one forest ants were controlled by spraying with tobacco extract.

Bakradze (S.). **О результатахъ искусственнаго разведенія лѣса послѣ сельско-хозяйственнаго пользованія въ Моршанскомъ лѣсничествѣ.** [On the results of afforestation after agricultural utilization of the soil in the Morshansk Forestry.] **«Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*], *Tambov*, v, no. 2, 1916, pp. 13-14.

The plots referred to in this report were cut more than 10 years ago and, as in 1910 they appeared to be seriously infested with larvae of *Melolontha*, they were let for agricultural purposes for two years. One plot was put partly under water-melons and partly under millet in the first year and under rye in the second; in October 1912, furrows about 5 feet apart were ploughed on this plot, and in the spring of the following year it was planted with one- or two-year-old pine seedlings, and was twice weeded and hoed during the summer; in the autumn a loss of 60 per cent. attributable to the larvae was recorded; in 1914, two-year-old seedlings were planted, the loss in autumn from the same cause amounting to 45 per cent. The second plot was sown with millet in the first year and partly with oats and partly with potatoes in the second; the afforestation was begun in the spring of 1914, one-year-old seedlings being planted, and the loss in autumn from the larvae of *Melolontha* amounting to 50 per cent. On neighbouring

plots, which had not been put to agricultural uses before afforestation, the loss was 75–90 per cent. The small results obtained are attributed to the fact that 1911 and 1912 were years in which there were great numbers of adults and thus years of great activity of their larvae; that the first ploughing of the ground was not done at the most favourable time, *i.e.*, the summer months, when the larvae are near the surface; and that the most suitable crops were not selected, namely, roots and crops grown as green manure.

Bogoliubov (M.). **О результатахъ искусственнаго разведенія лѣса послѣ сельско-хозяйственнаго пользованія въ Серповскомъ лѣсничествѣ.** [On the results of afforestation after agricultural utilization of the soil in the Serpovsk Forestry.]—**« Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*], *Tambov*, v, no. 2, 1916, pp. 18–22.

The afforestation of some plots in this forestry was begun in 1912, after they have been put to agricultural use for some years previously, but the results do not show that this method has any great effect in decreasing the damage by larvae of *Melolontha*. In some cases the damage on such plots was greater than on neighbouring ones, not used for agricultural purposes previous to afforestation. The author does not, however, regard these results as conclusive, partly on account of the relatively short period on which the observations are based, and also because of the absence of data as to the infestation of the soil and the age of the larvae before afforestation. The necessity of more thorough trials over a longer period is urged.

Michailov (I.). **Лѣсокультурныя работы 1914 года.** [Forest-cultivation works in 1914.]—**« Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*] *Tambov*, v, no. 3–4, 1916, pp. 10–19.

This is a review of the work in the forests of the government of Tambov, from the reports of the foresters. The pests noticed were: larvae of *Melolontha*, which caused damage varying from 25 per cent. to 95 per cent. in the plantations; the pine weevil [*Hylobius, abietis*]; and the spruce weevil, against which traps of fresh spruce bark were used, the weevils being collected from under them and destroyed.

Vilman (I.). **Четыре основныхъ лѣсоводственныхъ вопроса.** [Four fundamental questions of forest-cultivation.]—**« Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*], *Tambov*, v, nos. 3–4, 1916, pp. 20–25.

The methods of cultivation adopted during afforestation are divided into two groups, according to whether they have to be combined with remedies for controlling the larvae of *Melolontha* or not. The first includes those methods which are directed towards improving the physical qualities of the soil, so as to allow young seedlings to develop sufficiently to be able to resist attack. This can be effected by repeated weeding, combined with thorough cultivation of the upper layers of the soil, both along the lines of trees and in the spaces between them:

although expensive, this is the only practicable and successful method in places infested with the larvae. The ground must not be cleared of its covering of débris, the removal of which favours the development of this pest. When replanting the felled areas in the presence of larvae of *Melolontha*, it is advisable to plant in the first instance some deciduous tree, such as birch, which is less injured, subsequently introducing pines by degrees.

VILMAN (I.). **О врагѣ сосны-осины и о мѣрахъ борьбы съ ней въ связи съ борьбой съ майскимъ хрущемъ.** [On the enemy of pine—the aspen-tree—and its elimination in connection with the control of *Melolontha*.]—**« Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*], *Tambov*, v, nos. 3-4, 1916, pp. 26-28.

As aspen trees favour the spread of the fungus, *Coeoma pinitorquum*, the removal of these trees from pine plantations is very important. Since the adults of *Melolontha* oviposit preferably on uncut areas and mainly around their edges, the practice of felling in patches should be discontinued.

VILMAN (I.). **О мѣрахъ борьбы съ долгоносикомъ.** [On the control of *Hylobius abietis*.]—**« Лѣсная Жизнь и Хозяйство.»** [*Forest Life and Economy*], *Tambov*, v, nos. 3-4, 1916, pp. 29-30.

The control of *Hylobius abietis* is based on the inability of the weevil to fly. Preventive measures include trap trenches, one foot wide and one foot deep, with vertical walls, having at their bottom pits of about 1 foot cube, at intervals of 60 or 70 feet. Where the area is infested before the trees are felled, it must be left unplanted for two years, when the weevils will be driven out by lack of food and will be intercepted by the trenches. As the weevils winter in the pupal stage underneath the thick bark of pine and spruce stumps, these must be barked during the felling or early in the following spring, and this should be stipulated in all contracts for the sale of timber. In the third year the felled areas may be replanted, but trap trenches must be maintained for two or three years more. Should the weevils appear on freshly replanted areas, the only practicable remedy consists of traps formed of pieces of pine, $1\frac{1}{2}$ feet long and 4–6 inches thick, split in two, two or three cuts being made with a knife in the bark deep enough to reach the cambium, so as to produce an exudation of pitch. These should be placed in the spaces between the lines of trees, at regular intervals, having their bark side downwards. The weevils which settle on these logs must be collected twice a day, and the logs themselves renewed every two or three days as they become dry.

KUZNETZOV (A.). **Новый врагъ окулянтовъ въ плодовомъ питомникѣ.** [A new enemy of buddings in fruit-nurseries.]—**« Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 8, August 1916, pp. 428—rew., 8 figs.

Shoots of apples, pears, cherries, plums and apricots, which had been budded in July and August of the preceding year, were found in the following spring to be broken at the bases in the case of those shoots

which either emerged from the earth or were budded close to it. The cause of the damage was traced to wireworms, and therefore, notwithstanding the advantages of low budding, this must be done not lower than 2 inches from the surface of the soil in places infested with these pests. Similar damage is also done by Tenebrionid larvae. A general account of Elaterid larvae and their control is given. The species known to injure plants include:—*Lacon murinus*, L., *Athous subfuscus*, Müll., *Corymbites aeneus*, L., *Agriotes lineatus*, L., and *Dolopius marginatus*, L., these species being figured.

PLIGINSKY (V.). **Медяницы и борьба съ ними.** [*Psylla* spp. and their control.]—**«Садоводъ.»** [*The Horticulturist*], *Rostov-on-Don*, no. 8, August 1916, pp. 443-446.

The genus *Psylla*, of which one species attacks apple trees, while five species occur on pear trees [see this *Review*, Series A, ii, p. 334], is the commonest and most serious pest of orchards in Central and Southern Russia. The best method of control consists in fumigation with tobacco dust, on the results of which against the adults the author has previously reported [see this *Review*, Ser. iv, p. 169]. Further experiments both in the laboratory and in the open with this remedy against the nymphs have also proved successful.

ANUTCHIN (A. V.). **Наставленіе къ сбору, храненію и пересылкѣ насѣкомыхъ и др. животныхъ, и образцовъ поврежденныхъ растеній.** [Instructions on the collection, preparation and transport of insects and other animals, and of samples of injured plants.]—**Винодѣльческая Станція Русскихъ Виноградарей и Винодѣловъ. Энтомологическій Отдѣлъ.** Published by the [Entomological Section of the Viticultural Station of Russian Vinegrowers and Winemakers], *Odessa*, 1916, 23 pp., 10 figs.

An Entomological Section has been lately established at the Viticultural Station of Russian Vinegrowers and Wine-Makers in Odessa, the operations of which are to extend over all the vine-growing districts of European and Asiatic Russia. This pamphlet, the author of which is in charge of the new Section, invites correspondents to send information as to injuries by insect pests to the Bureau and gives general instructions as to the methods of collecting and preserving insect pests and of forwarding infested plants.

ANDREIEV (V.). **Вредныя насѣкомыя въ садахъ Подольской губерніи въ 1916 году и виды на урожай фруктовъ.** [Insect pests in the orchards of the govt. of Podolia in 1916, and the prospects of the fruit harvest.]—**«Подольскій Хозяинъ.»** [*The Podolian Farmer*], *Vinnitza*, no. 7-8, July-August 1916, pp. 29-31.

The meteorological conditions of the winter of 1915 and the first part of 1916 were exceedingly favourable to the increase of insects and, coupled with the absence of any control methods in many orchards, led to a very large outbreak of many pests in the spring of 1916. The following were particularly injurious to orchards: *Aporia crataegi*, of

which an outbreak is to be expected again in 1917, if no control measures are applied during the winter; *Euproctis chrysorrhoea*, the numbers of which were somewhat checked in some localities by its parasites; *Anthonomus pomorum*; *Hyponomeuta malinellus*; and *Cydia pomonella*. There were also present, although in much smaller numbers, *Lymantria dispar*, *Malacosoma neustria*, *Rhynchites pauxillus*, *R. bacchus*, *Psylla mali* and *P. pyricola*. A species of *Phyllotreta* and *Chortophila* (*Anthomyia*) *brassicae* damaged cabbages.

Примѣненіе въ садахъ желѣзнаго купороса. [The application of iron sulphate in orchards.]—**«Русскіе Субтропики.»** [*Russian Subtropics*], Journal of the Agricultural Society and of the Botanical Garden of Batum, *Batum*, ix, no. 6–7, 1916, pp. 103–104.

Iron sulphate is chiefly used and gives the best results in the destruction of lichen and moss, but it may be also used for the control of *Psylla mali*, for which purpose a 3 per cent. solution (1 lb. of iron sulphate in 3 gallons of water) is sprayed before the buds swell. According to Balabanov, this spray, even when most carefully used, will only destroy 30–50 per cent. of the eggs, and another spray with tobacco against the hatching larvae is indispensable. No lime need be added to the solution.

SCHØYEN (T. H.). **Beretning om skadeinsekter og plantesygdommer i land og havebruket 1915.** [Report on the injurious insects and fungi of the field and the orchard in 1916], *Kristiania*, 1916, pp. 37–92, 30 figs.

Owing to the cold spring in the southern part of the country the growth of cereals was greatly retarded, which exposed them for a longer time than usual to the attacks of wireworms, which were reported as doing damage in many places. *Galeruca* (*Adimonia*) *tanaceti* injured oats, and *Hypera* (*Phytonomus*) *rumicis* attacked the leaves of barley, without however causing any serious injury. Examples of the Longicorn, *Strangalia quadrifasciata*, were found on the ears of oats and barley, which were severely infested with *Macrosiphum granarium* (*Aphis cerealis*) and it is probable that the beetles had been attracted by the honeydew secreted by these Aphids. Other cereal pests were *Hadena basilinea* on barley, *Oscinella* (*Oscinis*) *frit* on oats and barley, *Chlorops taeniopus* on barley, *Hydrellia griseola* on oats, *Hylemyia coarctata*, and *Lygus pabulinus*. *Macrosiphum granarium* (*Siphonophora cerealis*) was fairly common in July and August over a large area. Oats suffered most, but barley, rye and wheat were also attacked. All specimens sent this year belonged to this species, whereas in 1914 it was *Aphis avenae* which caused the injury. The fact that *A. avenae* did not occur in any numbers in 1915 is thought to be due to its enemies being already numerous enough in the spring to check its spread, while *M. granarium*, on the other hand, appeared so late in the summer that by that time, the parasites and predaceous enemies had succumbed to starvation. A thrips, *Physapus vulgatissimus*, occurred on oats, and a spring-tail, *Aphorura armata*, injured the young shoots of different cereals in company with *Hylemyia coarctata*.

Insect pests of grasses included :—*Clidogastra* (*Cleigastra*) *flavipes* on timothy-grass, the larvae of *Tipula oleracea*, and *Pediculoides graminum*. Insect pests of vegetables included :—*Bruchus atomarius* in seeds of vetch, *Sitones lineatus*, *Cydia* (*Grapholitha*) *nebritana*, *Acyrthosiphon pisi* (*Siphonophora ulmariae*) and *Kakothrips* (*Thrips*) *robustus* on peas. Potatoes were attacked by Nematodes, *Serica brunnea*, *Meloë violaceus*, *Rhopalosiphum* (*Siphonophora*) *solani*, and *Physapus vulgatissimus*. The larva of *Polia* (*Mamestra*) *oleracea* seriously damaged the fruit of tomatoes. Beets were attacked by wireworms and the larvae of *Pegomyia hyoscyami* (*Anthomyia conformis*) mined the leaves. *Forficula auricularia* did great damage in many parts of the country to different kinds of vegetables, especially cabbage. Turnips were attacked by *Melolontha hippocastani*, *Galeruca tanaceti*, *Meligethes aeneus*, *Phyllotreta* (*Haltica*) *nemorum*, and the Carabid, *Bembidion lampros*, which was said to be very numerous in the cabbage fields, destroying the young plants. This appears to be the first recorded instance of damage by the last-named species. The caterpillars of the following Lepidoptera were recorded as injuring cabbage: *Pieris brassicae*, *Barathra* (*Mamestra*) *brassicae*, *Polia* (*Mamestra*) *pisi*, *P.* (*M.*) *oleracea* and *Plutella maculipennis* (*cruciferarum*). Other cabbage pests were *Eurydema oleraceum*, *Aphis brassicae*, *Tipula oleracea*, *Chortophila* (*Phorbia*) *brassicae*, and *Perrisia* (*Dasyneura*) *brassicae*. Carrots and parsley were attacked by *Psila rosae* and hops by *Vanessa urticae* and *V. io*.

Insect pests of fruit trees included :—*Aphis pomi* and *Psylla mali*, which is the most serious pest of apples. The use of nicotine sprays against it is steadily gaining ground, and has in many instances given excellent results. *Psylla pyrisuga* also attacked apples in some localities. Other apple pests included :—*Orthotylus marginalis*, *Psallus ambiguus*, *Lepidosaphes ulmi* (*Mytilaspis pomorum*), *Elater* (*Ampedus*) *sanguinolentus*, devouring the interior of the flower-buds, *Phyllobius argentatus*, *P. pyri*, *P. maculicornis*, *P. oblongus*, *Anthonomus pomorum*, *Telephorus obscurus*, *Xyleborus dispar*, *Galerucella* (*Galeruca*) *lineola*, *Lyonetia clerckella*, *Parornix* (*Ornix*) *guttea*, *Argyresthia conjugella*, *Hyponomeuta variabilis*, *Hemerophila* (*Simaethis*) *pariana*, *Eucosma* (*Tmetocera*) *ocellana*, *Olethreutes* (*Penthina*) *variegana*, *Cydia pomonella*, and *Cheimatobia brumata*, which defoliated the apple trees in many places. Pears were attacked by *Phyllobius argentatus*, *P. maculicornis*, *Xyleborus dispar*, *Xylina* (*Calocampa*) *vetusta*, *Oxygrapha* (*Teras*) *holmiana*, *Psylla pyrisuga*, *Contarinia* (*Diplosis*) *pyrivora*, and *Perrisia* (*Dasyneura*) *pyri*. *Eriophyes pyri* has caused many enquiries from different parts of the country, and the opinion now prevails that the injury caused by this mite is considerable. As a remedy the author recommends spraying with sulphur, 1 lb., and lime, 1 lb. in 2 gals. of water; half the water is heated nearly to boiling, the lime is added and then the sulphur; the rest of the water is then added and the whole boiled for one hour. This should only be used as a dormant spray and has given excellent results. Pests of plums, peaches and apricots included :—*Phyllobius pyri*, *Eriocampoides limacina* (*Eriocampa adumbrata*), *Aphis pruni*, which again did serious damage, *A. cerasi*, and *Eulecanium* (*Lecanium*) *persicae*. Cherries were attacked by *Phyllopertha horticola*, *Episema* (*Diloba*) *coeruleocephala*, *Cheimatobia brumata*, *Lyonetia clerckella*, and *Argyresthia ephippiella*. *Pteronus*

(*Nematus*) *ribesii*, *Zophodia convolutella*, *Eulecanium* (*Lecanium*) *ribis* and *Bryobia ribis* infested raspberries. *Incurvaria capitella*, *Eriosoma ulmi* (*Schizoneura fodiens*), *Rhopalosiphum ribis*, which did a very great deal of damage, and *Eriophyes ribis* infested currants. Strawberries were attacked by *Blaniulus guttulatus*, *Julus londiniensis*, *Tarsonemus fragariae*, *Aphrophora* (*Philaenus*) *spumaria* and *Anthonomus rubi*.

Miscellaneous garden pests included :—*Typhlocyba rosae* on roses, *Heliothrips haemorrhoidalis* on azalea in hot-houses, *Eriocampoides aethiops* defoliating roses, *Tortrix bergmanniana* in orchards, and the larva of the Arctiid, *Diacrisia lubricipeda* (*Spilosoma menthrastri*), on pansies. The larva of the Noctuid, *Trigonophora* (*Brotolomia*) *meticulosa* has injured cultivated daisies for several years in many localities, and this appears to be the first record of this insect as a pest.

Household pests included :—*Dermestes lardarius*, *Ptinus fur*, *Sitodrepa panicea*, very common in hard rye-bread kept in store as war provisions in private houses in Christiania, *Tribolium confusum*, introduced with flour from North America, and *Tribolium castaneum* (*ferrugineum*). A cargo of rice from Calcutta was seriously infested with *T. castaneum*, *Silvanus surinamensis* and *Calandra oryzae*. *Pyralis farinalis* and *Tinea granella* also occurred in stored cereals. On account of the great quantities of flour kept in store all over the country owing to the war, flour mites increased very considerably, the species concerned being: *Aleurobius farinae*, *Glyciphagus spinipes* and *Tyroglyphus longior*. *Anobium striatum* damaged furniture and old books; *Callidium violaceum* was very common in a brewery; while *Tinea pellionella* occurred in furs and stuffed furniture, and *T. fuscipunctella* in bedding.

SCHØYEN (T. H.). **Om skadeinsekter og snyltesopp paa skogstraerne i 1914.** [On injurious insects and fungi of forest trees in 1914.] *Kristiania*, 1915, pp. 150-155, 10 figs.

The adult larvae of *Dendrolimus pini* were found in Skjaerhalden, Hvaler, in the end of May, but not in sufficient numbers to be of serious importance. *Bupalus piniarius* was reported to be numerous in the pine forests on the western side of Kirk Island, but no important damage by the larvae was noticed. *Cydia* (*Grapholitha*) *strobilella* was reported from Lillehammer, and *Dioryctria abietella* was found in the cones of spruce trees at Askim and in the cones of larch trees at Kristiania. *Rhyacionia* (*Retinia*) *turionana* injured the pine trees at Bygland in Saetersdalen, many terminal buds, especially of young trees, being excavated by the larvae. This is the first record of this moth as injurious in Norway, it previously having been considered to be very rare. As the damage caused by this species greatly resembles that caused by *R. buoliana*, it is suggested that there has been a confusion between the two species. The larva of *Phyllopertha horticola* during the summer and autumn injured spruce, pine and larch in a nursery near Trondhjem. *Lophyrus pini* was recorded from various localities and one plantation of 10-year-old trees was all but defoliated by it. *Lophyrus rufus* was reported from Förde in Søndhordland. *Chermes pini*, which did great damage in 1913 in the western part of the country, also occurred in several localities in pine plantations. Near Kristiania, where young ornamental pine trees of different species

were severely attacked, the English "XL. All" insecticide paste was employed with good results. The author also recommends the use of a nicotine spray, prepared as follows:—About five pints of boiling water is poured on one pound of tobacco waste and this is kept one day; one pound of soft soap is dissolved in the same quantity of water and four parts of the tobacco extract are mixed with three of soap solution, to which is added 40 parts of water. The earlier in the summer this spray is applied the better are the results, as the younger Aphids are less protected by wax than the adults. *Chermes strobilobius* was reported on larch and *C. abietis* damaged spruce in several localities. *Lachnus tomentosus* appeared abundantly on five-year-old pine trees at Holer in Vinger. *Cossus cossus* was found to be attacking some old birch trees, and in the southern part of the country *Hyponomeuta euonymellus* defoliated bird-cherry trees. Birch forests were seriously damaged by an unidentified Lepidopteron, which may have been some species of *Eriocrania* (*unimaculella* or *sparrmannella*), which genus in 1874, 1875, 1879 and 1883 defoliated the mountain birch forests in parts of Norway. *Amphimallus* (*Rhizotrogus*) *solstitialis* and *Melolontha hippocastani* destroyed the foliage of deciduous trees at Rjukan and Filtvedt, and *Brachyderes incanus* at Nissedal attacked the shoots and leaves of young birch trees. In the Botanical Garden of the University of Kristiania, *Cryptorrhynchus lapathi* destroyed several species of *Salix*. *Galerucella* (*Galeruca*) *lineola*, which has devastated alders in the western part of the country for several years in succession, has continued its ravages this year in several localities. Enormous numbers of beetles were drowned in the lakes and the fjords, and the remarkably good condition of the trout during these years is undoubtedly due to the fact that these beetles provided them with an excellent food. *Melasoma* (*Chrysomela*) *populi* occurred on poplars at W. Aker, and *Cassida nebulosa* attacked birch trees at Nissedal. Larvae of *Cimbex variabilis* were recorded on birch trees from Jelsen, and *Croesus* (*Nematus*) *septentrionalis* occurred on Italian poplar and on birch. Galls of *Pontania proxima* on willow were sent from Hylla and those of the Cynipid, *Biorrhiza pallida*, on oak from Nesodden.

The following Aphids were sent for identification: *Eriosoma* (*Schizoneura*) *ulmi*, *Drepanosiphum platanoides*, *Pterocallis tiliae* and *Aphis padi*. An attack of *Psyllopsis fraxini* was recorded in some localities and lime trees suffered from *Tetranychus telarius*. *Anobium striatum* occurred in furniture and *Hylotrupes bajulus* seriously damaged timber in houses. As a remedy against *Formica herculeana*, the use of potassium cyanide (3 grms. to one litre of water) or 4 per cent. formalin or carbolineum is suggested.

TULLGREN (Alb.). **Om blyarseniatet och dess användning gentemot skadeinsekter.** [Arsenate of lead and its use against noxious insects.]—Centralanstalten för Jordbruksförsök, Flygblad, no. 59, Mai 1916. *Entomologiska avdelningen*, No. 14. [Central Station for Agriculture, Circular no. 59, May 1916, Entomological Series, no. 14.]—*Stockholm*, 1916, 2 pp.

The use of arsenate of lead against noxious insects, hitherto prohibited in Sweden, has, since the 25th February 1916, been permitted

by Royal Edict, provided that, when offered for sale, it is coloured by an addition of 5 per cent. of chromate of lead. The properties and the preparation of this poison as a spray, as well as the advantages derived from its use, are briefly outlined.

IVERSEN (Karsten) & ROSTRUP (Sofie). **Forsög vedrörende Klöverålens smit teevne.** [Experiments regarding the mode of infection of *Tylenchus devastatrix*.] 106. *Beretning fra statens Forsögs virksomhed i Plantekultur, Copenhagen*, 1916, pp. 424-441.

Tylenchus devastatrix is common in Denmark in clay soil, both on the islands and in Jutland, the injury caused by it every year being very considerable. The attack is the more serious, the more frequently red-clover is cultivated in the same field. This is a natural consequence of the life-history of this Nematode. The best method of control is to starve it by eliminating clover from the rotation for five or six years. The method of starvation, however, does not invariably give satisfactory results and this suggests that the fields thus treated become infected again later, independently of the earlier infection. Experiments were therefore made as to the method of dispersal from one locality to another. Soil in which the débris of infected plants had been buried in the autumn transmitted infection to clover sown the following spring. Hay or green plants which had been buried in manure heaps, on the other hand, soon lost their power of infection, though hay, stored dry, proved to be a certain source of infection. The evidence goes to show that *Tylenchus devastatrix* may also be spread with the crop from the infected fields. If, for instance, grass or clover from these is dropped on other fields during transport to the stack, these fields may become infected. On the other hand, if infected grass or clover is kept in a manure heap for at least one month there is no danger of infection, though when placed on top of a manure heap for a short time it retains its ability to spread infection. The most certain way to control this eel-worm is to drop clover out of the rotation for a time and substitute *Lotus corniculatus*, bird's-foot trefoil.

SYLVÉN (Hj.). **Märgborrfaran för våra tallskogar.** [The danger to our pine forests from *Myelophilus piniperda* and *M. minor*], *Skogen*, 1916, pp. 153-161, 3 figs.

The author points out that danger from these beetles is underrated in Sweden, many people considering it useless to attempt any methods of control. He suggests that for every tree felled a certain small sum should be put aside and spent in order to protect the forest from them. Details relating to their biology and development are given, and the removal of the bark from the trees and stumps before the larvae pupate is strongly recommended.

SAALAS (Uunio). **Vara grannars fiender bland skalbaggarne.** [The beetle enemies of the spruce.]—*Uppsatser i Skogsbruk redigerade av Finska Skogsvardsforeningen Tapio.* [Papers on forestry abstracted from (the journal of) the Finnish Foresters' Association], *Helsingfors*, 1916, no. 6, pp. 91-95; nos. 7 & 8, 1916, pp. 110-116, 9 figs.

During his investigations on the beetles found regularly on spruce. the author has discovered, in all, 289 different species, which are more or

less dependent on this tree. Of these only 37 per cent. derive their food from solid substances of the tree, the rest feeding on the juices of the tree, on fungi, etc. In the present paper only those species are dealt with which live in the cambium, belonging to the families SCOLYTIDAE, CERAMBYCIDAE, ANOBIIDAE, CURCULIONIDAE and BUPRESTIDAE. The only Scolytid that is always a primary pest is *Dendroctonus micans*, Klug, which is, however, very rare in Finland. The most common species is *Ips typographus*, L., and groups or single trees are often found which apparently have been killed by this insect. The fact that *I. typographus* is better known than the other bark-beetles of spruces renders it very probable that this species is often accused of the death of trees which have in reality been killed by others. Next to *I. typographus* in importance come *Pityogenes chalcographus*, *Polygraphus poligraphus* and *P. subopacus*, which are also found on perfectly healthy trees. The latter species is regularly found, together with *I. typographus*, usually in the upper part of the tree, though it often attacks small spruces from the root to the top. *P. poligraphus* and *P. subopacus* can only with difficulty be distinguished from one another and from the third Finland species *P. punctifrons*, Thoms. The latter, however, seems to prefer fallen trees, whereas the others mainly attack standing ones. In company with these species *Xylechinus (Kissophagus) pilosus*, Ratz., occurs on the mountain slopes, especially in the northern parts of the country.

The following species are comparatively rare, but may occasionally be dangerous :—*Pityophthorus fennicus*, E., occurring on the trunk and branches of weak standing trees, measuring about 2–6 inches in diameter ; *Ips duplicatus*, Sahlb., only occurring on trunks cut off about 3½–5 feet above the ground, but found also on one occasion on a healthy tree ; *Ips suturalis*, Gyll., which seems to prefer trees damaged by fire, and *Cryphalus saltuarius*, Weise, which is fairly common in the northern part of the country, where, especially on the mountain slopes, it kills the small trees. Still more rare, but probably as dangerous as the above, are *Pityogenes saalasi*, E., *Phloeophthorus (Phthorophloeus) spinulosus*, Rey, and *Cryphalus abietis*, Ratz. Other species that are very common, but do not play any important part because they are secondary pests, are *Hylastes palliatus*, Gyll., *Crypturgus pusillus*, Gyll., *C. hispidulus*, Thoms., and *C. cinereus*, Herbst. The following species only occur in fallen trees or stumps and are consequently of little or no importance, viz :—*Polygraphus punctifrons*, Thoms., *Hylastes cunicularius*, Er., *H. glabratus*, Zett., *Ips laricis*, F., *Dryocoetes autographus*, and *D. hectographus*, Reitt.

Of the CERAMBYCIDAE the following three species are very common and primary in character of attack :—*Tetropium castaneum*, L., *T. fuscum*, F., and *Callidium coriaceum*, Payk. *Tetropium* makes the pupal chamber rather close to the surface, while *Callidium* often penetrates the wood to the centre. *Tetropium* seems to prefer the lower part of the trunk and is very often found in trees where *Ips typographus* has attacked the rest of the trunk and *Pityogenes chalcographus* the top and the branches. Although the larvae of these beetles are very common, the imagines are comparatively rare, because the lvarae have so many enemies, both Hymenopterous and Dipterous, as well as wood-peckers, which diminish their number before they pupate. *Cacnoptera minor* and *Semanotus undatus*, which live in slender trees,

as well as *Pogonochaerus fasciculatus*, de G., which prefers the branches, are also injurious. *Rhagium inquisitor*, L., is perhaps more injurious owing to its numbers than the last-named, although it is normally a secondary pest.

There are only two Anobiids, *Ernobius explanatus*, Mann., and *Anobium thomsoni*, Kraatz, which are comparatively common and sometimes primary. The former lives during the entire larval period under the bark, where it also pupates; the latter lives in the interior of the tree, excavating in all directions. A third member of this family, *Anobium emarginatum*, Duft., is always primary, but is nevertheless harmless, because it lives in the dead parts of the bark, never penetrating to the cambium. Of the CURCULIONIDAE, *Pissodes hercyniae*, Herbst, is the only species found; it occurs under the bark of half-dead spruces. It is sometimes very common, its winding galleries leaving their mark on the whole trunk. Of the BUPRESTIDAE the most important is *Anthaxia quadripunctata*, which is common. *Phaenops cyanea*, F., is so rare as to be of little consequence. *Melanophila acuminata*, de G., the larvae of which are regularly to be found under the bark of trees injured by fire that in many instances would probably have recovered, is probably more injurious.

LIRO (J. L.). **Märgborrarne.** [The pine beetles.]—*Uppsatser i skogsbruk, redigerade av Finska Skogsvårdsföreningen Tapio.* [Papers on forestry abstracted from (the journal of) the Finnish Foresters' Association], *Helsingfors*, 1916, no. 9, pp. 126–132, 8 figs.

This paper gives a summary of the biology and damage done by *Myelophilus piniperda* and *M. minor* and records injuries on *Pinus cembra*, *P. strobus*, *P. austriaca*, *P. nigricans*, *P. maritima*, *P. laricio* and *P. pinea*, as well as on spruce. Some observations tend to show that these beetles may be attracted from a distance of from 5 to 10 furlongs when in search of food.

WELANDER (Adolf). **Barkborrens förmaga att döda friska granar experimentelt bevisad.** [Experimental evidence that *Ips typographus* is able to kill perfectly healthy spruce trees.]—*Skogsvardsföreningens Tidskrift, Stockholm*, 1916, nos. 6–7, pp. 520–526, 3 figs.

In some experiments made to solve the problem whether bark-beetles are able to kill perfectly healthy trees, two spruce trees were surrounded loosely about 12 feet above the ground by brass-gauze 2 feet wide and fastened at both ends by wire. In these cages about 450 bark-beetles (*Ips typographus*) were enclosed on the 25th May 1913. The beetles immediately began to seek refuge in the crevices of the bark, where they started making their galleries. On the 9th June the gauze was removed and 40 per cent. of the beetles were found dead, the rest having entered the bark. Many of these had made their escape from the gauze, but afterwards penetrated the bark above or under the wires. The high percentage of dead beetles may have been due partly to the conditions of the experiment, some being probably injured when collected. They were, however, very rarely caught in the resin, as they always retreated in good time. The trees were inspected on

the 2nd of August, when both were found to be dead. The next year the experiments were repeated, muslin being used instead of the metal gauze. At the end of August one of the trees was felled. The egg-galleries were then 2–6 ins. long and their number did not suggest that any other bark-beetles had been attracted to the tree. No larval galleries were developed, but undeveloped eggs were found here and there in the galleries. The walls of the egg galleries were quite hard and polished, as if impregnated with resin, and were excavated between the dead and the living part of the bark, the latter and the cambium behind it being killed. That the trees themselves were not killed on this occasion is thought to have been due to the bark-beetles being too few. In 1915, at the beginning of June, the experiments were again repeated on eight trees. On the 15th of July the bark surrounded by the muslin was quite dead and by the middle of August all the trees were killed.

TRÄGÅRDH (Ivar). **Människans andel i insekthärjningarnes uppkomst.** [The part played by man in the origin of insect ravages.]—*Ymer, Stockholm,* 1916, no. 3, pp. 273–281.

This is a popular treatise on the methods by which man has himself brought about the ravages of insects. When a plant was first cultivated, it is probable that all insects dependent on it increased enormously, with disastrous results. The same will doubtless occur again whenever a wild plant comes under cultivation. In many instances by exterminating wild plants man has driven the insects feeding on them to attack closely related cultivated plants, as happened when the Colorado beetle [*Leptinotarsa decemlineata*] became a pest of the potato; when *Thecla melinus* in the U.S.A., which originally lived on *Astragalus mollis*, became a pest of beans, peas, cotton and maize; and when *Bruchus brachialis*, which in the South of Europe lived on wild species of *Vicia*, attacked *Vicia villosa* at the beginning of this century in France. The pests of one country have been introduced into others by the agency of man, as in the case of *Phylloxera*, the gipsy moth [*Lymantria dispar*], the brown-tail moth [*Euproctis chrysorrhoea*], the fruit fly [*Ceratitis capitata*], and other insects. The author summarises the instances where the biological method of controlling insect pests has been successfully applied, instancing the case of the cottony cushion scale [*Icerya purchasi*] in California, Marlatt's voyage round the world in search of the natural enemies of the San José scale [*Aspidiotus perniciosus*], and Silvestri's voyage to Africa on behalf of the Government of Hawaii in search of the enemies of *Ceratitis capitata*.

TULLGREN (Albert). **En ny strit,** *Typhlocyba Bergmanni,* **n. sp., från Norge.** [A new leaf-hopper, *Typhlocyba bergmanni*, sp. n., from Norway.]—*Entomologisk Tidskrift, Stockholm,* 1916, pp. 64–69, 1 fig.

A detailed description is given of *Typhlocyba bergmanni*, sp. n., found on Mauken, east of Trondhjem. This Homopteron appeared on a road at the beginning of August in countless numbers, where it was a serious nuisance to travellers. It is said to be closely related to *T. hippocastani*, Edw.

LJUNGDAHL (David). **Nagra lepidopterologiska anteckningar och puppbeskrivningar samt en del parasitstekelynd.** [Some notes on Lepidoptera with descriptions of pupae and notes on ICHNEUMONIDAE bred from them.]—*Entomologisk Tidskrift, Stockholm*, 1916, pp. 70–94, 37 figs.

The following ICHNEUMONIDAE are recorded :—*Pimpla examinator* from a pupa of *Vanessa urticae*, L., not previously recorded from this butterfly; *Labrorychus flexorius*, Thunb., from *Drepana falcataria* and *D. lacertinaria*; *Amblyteles subsericans*, Grav., from *Trachea (Hadena) illyrica*, Frr.; *Anilasta didymator*, Thunb., from *Graptolitha (Xylina) furcifera*, Hüfn.; *Casinaria ischnogaster*, Grav., from *Eupithecia (Tephroclystia) sobrinata*, Hb.; *Cratichneumon nigritarius*, Grav., from *Ematurga atomaria*, L.; *Heteropelma calcator*, Wesm., from *Bupalus piniarius*, L.; *Hepiopelmus leucostigmus*, Grav., from *Diacrisia lubricipeda (Spilosoma menthrastri)*. Excellent drawings by the author himself are given of the pupae of many Lepidoptera, including those of *Charaeas graminis*, *Polia* (*Mamestra*) *oleracea*, *P. contigua*, *P. pisi* and *Scotogramma trifolii*.

TULLGREN (Albert). **En lömsk fiende till var vän nyckelpigan.** [An insidious enemy of our friend the Ladybird.]—*Entomologisk Tidskrift, Stockholm*, 1916, pp. 95–98, 1 fig.

The Braconid, *Perilitus terminatus*, Nees, is recorded as having been bred from *Coccinella septempunctata*, L., near Stockholm.

NORSTRÖM (Fr.). **Lepidopterologiska notiser.** [Notes on Lepidoptera.] —*Entomologisk Tidskrift, Stockholm*, 1916, pp. 115–130.

The following Dipterous and Hymenopterous parasites of Lepidoptera were bred :—The Tachinids, *Phryxe (Exorista) vulgaris*, Fall., from *Pieris napi* and *Vanessa io*, and *Winthemia quadripustulata*, F., from *Pergesa (Metopsilus) porcellus*, L.; and the Ichneumons, *Paniscus cephalotes* and *Eurylabus larvarum*, from *Dicranura vinula*, and *Labrorychus tenuicornis* from *Drepana falcataria*, L.

COLEMAN (—). **Pests and diseases of coffee.**—*Planters' Chronicle, Bangalore*, xi, no. 37, 9th September 1916, pp. 456–458.

In a lecture on the pests and diseases of coffee, the author stated that though the green bug [*Coccus viridis*] had spread, it was not likely to ruin coffee in Coorg and Mysore, as its numbers had been kept down by fungi. Investigation has shown that at least four species of ants are associated with this scale. The coffee borer [*Zeuzera coffeae*] and other serious pests were troublesome during the past year. Repellents have proved useless against this borer and scrubbing the bark is the only treatment which can be recommended, as it removes a large number of eggs and the larvae cannot reach the tree from eggs which fall to the ground. From 150 to 200 trees can be treated in a day by one man.

FROGGATT (W. W.). **Forest Longicorn Beetles and their Parasites.**—*Agric. Gaz. New South Wales, Sydney*, xxvii, no. 8, August 1916, pp. 561-567, 3 plates. [Received 3rd October 1916.]

Phoracantha recurva, Newm., is common in New South Wales in *Eucalyptus novae-angliae* and *E. rostrata*. Observations made in the month of February showed that eggs are deposited upon the bark of fallen branches of *E. rostrata* in irregular rows. Newly emerged larvae were found on 8th March. Feeding takes place for several months under the bark, but later the larvae enter the deeper layers of the wood, in which position pupation takes place. It is parasitised to an extent of 70 per cent. in the larval stage, and is thus prevented from becoming a serious pest of timber. The Clerid, *Trogodendron fasciculatum*, is found in the larval stage in the galleries of *P. recurva*. The eggs of this parasite are probably laid upon the bark, and the larvae, upon hatching, work their way into the galleries of the host. Adults emerge in October and November. The Braconid, *Iphiaulax rubriceps*, sp. n., which also attacks the larva, is widely distributed in Australia; related species, *I. phoracanthae*, sp. n., and *I. morleyi*, sp. n., have been reared from cocoons found in the galleries of this Longicorn. *Bethelium munda*, Blackb., is widely distributed in Tasmania and Australia and in the larval stage bores into the small branches of *E. novae-anglicae*, causing them to break off. The whole of the larval and pupal stages, occupying at least two years, are passed within the branch. Where preventive measures are worth while, it would be possible to reduce the numbers of these beetles by burning the fallen branches.

FROGGATT (W. W.). **A Descriptive Catalogue of the Scale-Insects ("Coccidae") of Australia.**—*Agric. Gaz. New South Wales, Sydney*, xxvii, no. 8, August 1916, pp. 568-578, 2 plates. [Received 3rd October 1916.]

The following species of COCCIDAE are described:—*Eriococcus cypraeaeformis*, Full., on *Casuarina* sp. from Western Australia; *E. elegans*, Full., on *Casuarina humilis* from Western Australia; *E. eucalypti*, Mask., on *Busaria spinosa* (native blackthorn), *Pittosporum undatum*, *Myoporum* sp. and *Aster*; *E. gregarius*, sp. n., on several species of *Eucalyptus* near Sydney; *E. gurneyi*, Full., on an undetermined plant; *E. hakeae* on *Hakea ilicifolia* (needlewood); *E. imperfectus* on *Melaleuca* sp.; *E. irregularis*, sp. n., on *Eucalyptus piperita*; *E. leptospermi*, Mask., on *Leptospermum laevigatum*, *L. scoparium* and *Kunzea corifolia*; *E. multispinus*, Mask., on *Acacia armata* in Victoria and on *Epacris longifolia* in New South Wales; *E. picta*, sp. n., on *Eucalyptus* sp. in West Australia; *E. serratilobis*, Green, on *Eucalyptus gracilis*; *E. simplex*, Mask., on *Eucalyptus* sp.; *E. sordidus*, Green, on *Helichrysum ferrugineum* in Victoria; *E. spiniger*, Mask., on *Eucalyptus* sp. near Sydney; *E. tepperi*, Mask., on *Eucalyptus globulus* and *Busaria spinosa* in South Australia and on *E. viminalis* in Tasmania; *E. tessellatus*, sp. n., on *Eucalyptus* sp. in New South Wales; *E. tricarinatus*, Full., on galls of *Maskellia globosa*, Full., on *Eucalyptus gomphocephalus* in West Australia; *E. villosa*, sp. n., on *Busaria spinosa* in New South Wales.

Walton (W. R.) & Davis (J. J.). Cutworms and their Control in Corn and other Cereal Crops.—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 739, 1st June 1916, 3 pp., 1 fig. [Received 3rd October 1916.]

This paper gives an account of the habits, life-history and methods of control of *Lycophotia* (*Peridroma*) *margaritosa* and other cutworms.

Gibson (E. H.). The Corn and Cotton Wireworm in its Relation to Cereal and Forage Crops, with Control Measures. *U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 733, 9th June 1916, 7 pp., 3 figs. [Received 3rd October 1916.]

The Elaterid, *Horistonotus uhleri*, Horn, causes injury to cotton and maize in North and South Carolina, Illinois, Missouri, Arkansas and Mississippi. In the immature stages it appears to occur only in sandy soils. In addition to maize and cotton, the roots of other plants are attacked by the larvae, including :—Oats, rye, cowpea, Johnson grass, sweet potato, tobacco, water-melon, and a species of wild bamboo. Adults have been observed feeding on stems of cowpeas and leaves of maize and crabgrass. Larval injury results in the production of dwarfed, unhealthy plants. In the case of cotton, the larvae bore into the seed and cause the death of the very young plant. Adults are present from early June until the end of August. Eggs are laid during the end of June and during July in groups of from 3 to 20 in the soil round the roots of the host plants. Hatching takes place in from 8 to 11 days. The duration of the larval stage is two or possibly three years. Pupation occurs in the soil in May or June and adults emerge after about 12 days. During the spring and summer, larvae are to be found at depths varying from 2 to 18 inches. With the approach of winter they penetrate to deeper levels and in mid-winter occur at depths varying from 4 to 6 feet. During this period feeding practically ceases. Under experimental conditions larvae have been kept alive in moist sand without food for six months. They appear to be susceptible to extremes of moisture and drought. The adults fly at night and are capable of migrating several miles. Eggs are only deposited on recently ploughed fields.

Control measures include (1) early planting of crops, followed by frequent cultivation until the middle of June ; (2) crop rotation with clover, cowpeas, soy beans or grasses which do not require summer cultivation ; (3) manuring infested areas.

McGregor (E. A.). The Red Spider on Cotton and how to Control It. —*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 735, 12th June 1916, 12 pp., 10 figs. [Received 3rd October 1916.]

Injury to cotton by *Tetranychus telarius*, L., occurs in the southern parts of the United States. Attacks of this pest result in the discoloration and falling of the leaves and sometimes in the death of the plant. Infestation is limited to small areas ; it does not occur continuously over large tracts. In South Carolina the winter is mainly passed in the mature female stage ; a few males may be present, and during warm periods, eggs may be laid. Feeding takes place on wild

plants, such as evening primrose, hedge nettle, sow thistle, wild geranium, vetch, blackberry, and Jerusalem oak. The first spring generation of females develops about 31st March. Between this date and the end of May about five broods occur and migration to other weeds, garden plants, and cotton takes place. In the latitude of South Carolina the spring and summer generations mature in less than 11 days, while during an average season 17 generations are produced. The incubation period of the eggs of both sexes is about four days, though males reach maturity slightly sooner than the females. Mature females on cotton feed for about 18 hours before ovipositing. Eggs are deposited in clusters on the under surface of the leaves, each female laying about six eggs daily during a period of from 8 to 10 days. Feeding continues at intervals during the egg-laying period. The duration of the adult stage in summer is about 12 days; this period increases with a fall in temperature and in winter may extend over 150 days. Migration to winter hosts takes place in late autumn. In addition to the wild plants above mentioned, cultivated violets frequently become infested. Adult females are able to travel over smooth surfaces at the rate of 600 feet in 24 hours. Dispersal is effected by active migration, heavy rains, and by wind.

Predaceous enemies include mites, thrips, bugs, lacewing flies, Syrphid flies, midges, etc. Preventive measures include (1) the destruction of weeds in or near cotton fields; (2) control on cultivated plants by spraying with sodium arsenate at the rate of 1 lb. to 20 U.S. gals. water; (3) crop rotation with wild grasses and small grains; (4) the maintenance of a finely-pulverised surface mulch to hinder as far as possible migration from one plant to another; (5) the use of fertilisers to promote vigorous growth of the cotton plants. When infestation first appears in cotton fields, affected plants should be removed and destroyed. In cases of more general infestation, application of one of the following sprays is recommended:—(1) Potassium sulphide, 1 oz. to 2 gals. water; (2) lime-sulphur; (3) kerosene emulsion; (4) flour-paste solution, 1 gal. stock solution to 12 gals. water. The spray should be applied very thoroughly and should be repeated a week later.

GIBSON (E. H.). **The Clover Leafhopper and its Control in the Central States.**—*U. S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 737, 26th June 1916, 8 pp., 5 figs. [Received 3rd October 1916.]

Agallia sanguinolenta, Prov., occurs in southern Canada, throughout the United States, and in Mexico. The principal host plants include certain leguminous crops, such as lucerne, clover, cowpea and vetch. This Jassid is also common on native and cultivated grasses, and has been found on wheat and sugar-beet. The most serious injury to clover and lucerne in the central States is caused in the spring and early summer, when the epidermis of the stem and leaf is thin and easily punctured. Seed production may be affected by the puncturing of the flower buds and petals, while distortion or gall-formation may result from the deposition of eggs in the stem or leaf tissue. The incubation period of the eggs during the summer in southern Illinois varies from 5 to 12 days and the nymphal stage from 18 to 35 days.

In southern Missouri and northern Arkansas three broods occur annually, the first appearing in April and May, the second in June and July, the third in August and September. Further south it is probable that four or more generations are produced each year. In the northern States hibernation takes place in the adult stage at the base of grasses and weeds, while in the central States adults merely shelter during cold weather and come out to feed during warm days. In the extreme south-west activity is retained throughout the year.

Several species of wild birds, as well as poultry, feed on both the nymphs and adults of *A. sanguinolenta*. Among artificial methods of control are included (1) the burning of rubbish and vegetation along fences and roadsides during the winter months, (2) close cutting or pasturing of lucerne and clover crops and grass land, and (3) the use of the hopperdozer, preferably when the crop is about half-grown.

Cabbage Worms doing great Damage.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 37, 21st September 1916.

Injury by cabbage worms [*Pieris* spp.] may be prevented by spraying with lead arsenate at the rate of 2 or 3 lb. paste to 50 U.S. gals. water. This spray may be rendered more adhesive by the addition of 2 or 3 gals. resin-lye mixture, 3 or 4 lb. fish oil soap or a few pounds of glue to each 50 gals. of solution. Resin-lye mixture is prepared from 1 pt. fish oil, 5 lb. resin, 1 lb. concentrated lye and water to make 5 U.S. gals.

Leaf Rollers in Pennsylvania Orchards.—*Weekly Press Bull., Penns. Dept. Agric., Harrisburg*, i, no. 38, 28th September 1916.

The oblique-banded leaf-roller [*Cacoecia rosaceana*] has appeared in several orchards in Pennsylvania. In New York State this insect is injurious to the fruit and foliage of apple, pear, peach, plum and cherry. The larvae mature in June and adults appear about a month later. There is one generation annually, the winter being passed in the egg stage. The use of a miscible oil spray, such as Scalecide, has been found satisfactory for controlling the larvae.

Obiedoff (S.) & Pehlivanoglou (D.-V.). **Observations sur les insectes de la vigne (Eudémis et Cochylis) à l'Ecole Nationale d'Agriculture de Montpellier en 1915.** [Observations on *Polychrosis botrana* and *Clysia ambiguella* at the National School of Agriculture at Montpellier in 1915.]—*Ann. Ecole Nat. d'Agric., Montpellier*, xiv, no. 4, April 1915, pp. 261–281. [Received 5th October 1916.]

The results of these observations are shown in a 12-page table. A general study of the varieties of vine cultivated at the school was planned, but owing to partial losses there due to mildew and also owing to a possible immigration of moths from neighbouring vineyards ravaged by mildew, the conditions under which the work was done were exceptional and rather favourable to the insects. On each variety of vine a more or less characteristic bunch, bearing traces of an average attack, was examined, a count being made of the total number of grapes and of the number of infested grapes, the percentage of

infestation being shown in the first column of the table. The second part of the work comprised the classification of the insects infesting the grapes, usually as larvae, but also as pupae. Three columns show the number of *P. botrana*, *C. ambiguella* and unidentified insects, these being mostly pupae or larvae crushed during the process of examination. The data thus obtained in summer are of value for control measures to be taken in the following winter. The infestation varied from 81·1 per cent. to 0 per cent., and without determining the causes of this inequality, attention is drawn to the exterior characteristics of the bunches of the several varieties, those most subject to attack having bunches in which the grapes are close together. The shape of a bunch is immaterial, but the shape of the grapes has an appreciable influence. Elongate grapes, such as the Santa Paula, are a characteristic example of this: these grapes split down their entire length once they have been pierced. The split is very deep and the larva is compelled to attack another grape, leaving the first one spoilt even though very little feeding has taken place. The flavour of the pulp seems to have a marked effect on the extent of the injury and French vines seems to be preferred, though nothing definite can be said on this point owing to possible variations due to mildew injury in the vineyards. The varieties which are least attacked are those in which the bunches are normally very loose, or in which they have been thinned by mildew. Grapes which do not touch one another present difficulties to the passage of the larva. A particular case of immunity is connected with the volume of the pulp. In American vines, which have very little pulp, or in which the seeds fill most of the pulp, grapes may be noticed which have been attacked in various places without the insect penetrating. This must be either due to the flavour or to the fact that the volume of the pulp is too small to satisfy the larva. The count showed that *P. botrana* was predominant and of 931 individuals, there were 812 *P. botrana*, 80 *C. ambiguella* and 39 unidentified pupae.

CHAUVIGNÉ (A.). **La génération des Ampélophages dans le Centre, en 1916.** [Insect pests of the vine in Central France during 1916.]—*Rev. Viticulture, Paris*, xlv, no. 1162, 5th October 1916, pp. 216–219.

Observations made during 1916 in Central France, especially in Touraine, point to the growing preference of *Clysia ambiguella* and *Polychrosis botrana* for vines yielding white grapes, such as Gros-Pineau, Petit-Pineau, Folle-Blanche, Chasselas, etc. Infestation by *C. ambiguella* is diminishing, while that by *P. botrana* is increasing. High summer temperatures check these pests only if they occur at the time when the eggs are on the pellicle of the grape.

SILVESTRI (F.). **Descrizione di alcuni Imenotteri Braconidi parassiti di Ditteri Tripaneidi nell' India.** [A description of some Braconids parasitic on Trypaneids in India.]—Separate, dated 27th September 1916, from *Boll. Lab. Zool. Gen. Agrar. R. Scuola Sup. Agric., Portici*, xi, pp. 160–169, 6 figs.

This paper describes six new Braconids parasitic on Trypetid flies in India, viz:—*Bracon fletcheri* from fruits of *Zizyphus jujuba*, infested

with *Carpomyia vesuviana*, Costa; *Opius fletcheri* from pupae of *Dacus* (*Chaetodacus*) *curcubitae*, Coq., in the fruits of *Momordica charantia*; *Opius incisi*, from pupae of *Dacus* (*Chaetodacus*) *incisus*, Walk., infesting the fruit of *Careya arborea* (Jak); *Biosteres carpomyiae* from pupae of *C. vesuviana*; *Biosteres persulcatus* and *B. compensans* from pupae of *D. incisus*. Two females of *B. compensans*, considerably smaller than the type, were bred from pupae of *D. incisus* infesting *Solanum verbascifolium*.

MALENOTTI (E.). **Nuovi Diaspiti.** [New Diaspids.]—Separate, dated 12th October 1916, from *Redia, Florence*, xii, no. 1, pp. 183-194, 1 plate.

This paper describes three new Diaspids:—*Lepidosaphes tuberculata* from leaves of *Cymbidium tracyanum* in greenhouses at Florence; *Lepidosaphes diaspidiformis* from leaves of *Mirecujenia planipes*, collected in Chili; *Dinaspis annae* found together with *Lepidosaphes beckii*, Newm. (*citricola*, Pack.), and *Chrysomphalus* (*Aonidiella*) *aurantii*, Mask., on *Citrus medica acida* in Barbados.

BARROETAVEÑA (F. A.) & GIROLA (C. D.). **Segundo resumen de los trabajos efectuados por la comisión nacional, designada por el Ministerio de Agricultura para propagar la Prospaltella (*Prospaltella berlesei*, How.), como medio de destruir la Diaspis (*Diaspis pentagona*, Targ.), durante el segundo periodo, desde Abril a Noviembre de 1915.** [Second resumé of the work done by the National Commission nominated by the Ministry of Agriculture to establish *Prospaltella berlesei*, as a means of destroying *Aulacaspis pentagona*, during the second period of working, from April to November 1915.]—*Bol. Minist. Agric., Buenos Aires*, xx, nos. 5-6, May-June 1916, pp. 314-324, 1 col. plate. [Received 13th October 1916.]

A report of the work done in 1914 has already been abstracted [see this *Review*, Ser. A, iv., p. 18]. From June to mid-October 1915, 929,776 twigs parasitised by *Prospaltella berlesei* were distributed to 2,523 fruit-growers in 245 localities in Argentina. No twigs were sent to localities free from *Aulacaspis pentagona* and in doubtful cases a careful inspection was made in order to avoid infesting immune areas. The necessity for a further distribution depends on the conditions observed before the next period June-October, 1916. In the opinion of the Commission good results have been obtained up to the present and instances are cited in support of this. On the twigs which were distributed the following other insect enemies of *A. pentagona* were noted:—*Rhizobius lophantae*, Blaisd., *Coccidophilus citricola*, Breth., and *Salpingogaster nigriventris*, Big. Lahille has recorded the following Aphelinine parasites of *A. pentagona* in Argentina:—*Aphelinus fuscipennis*, How.; *Archenomus bicolor*, How., *Aspidiotiphagus citrinus*, Crwf., *Tetrastichus canadensis*, Ashm., *Prospaltella martfeldti*, How., and *Signiphora aspidioti*, Ashm. Brèthes has recorded:—*Prospaltella aurantii*, How., *Trichogrammatoidea signiphoroides*, Breth., *Diaspidophilus pallidus*, Breth., *Prospaltoides howardi*, Breth., *Signiphora caridea*, Breth., *S. platensis*, Breth., and *Dimacrocerus platensis*, Breth.

The Commission never had an opportunity of ascertaining that any of these parasites and hyperparasites had attained the same diffusion as *P. berlesei*, but recognises that some of them are useful auxiliaries. It was not possible to ascertain whether epidemic infection of the kind suggested by Grassi [see this *Review*, Ser. A, iv, p. 200] was responsible for some deaths which were neither natural nor due to parasitation by *P. berlesei*.

GIBSON (A.). **Reports on Insects of the Year; Division no. I, Ottawa District.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 11–14, 1 fig. [Received 10th October 1916.]

The following insects were recorded as attacking field crops:—*Melanoplus atlantis* (lesser migratory locust) and *Camnula pellucida* on oats, barley, timothy, clover, etc.; *Euxoa tessellata* (striped cut-worm) on beets, carrots and onions; *E. messoria* (dark-sided cutworm) and *E. ochrogaster* (red-backed cutworm) on various vegetables; *Chortophila* (*Phorbia*) *brassicae* (cabbage maggot) on cauliflower, cabbage, turnips and radish; *Hylemyia antiqua* (imported onion maggot); *Chortophila fusciceps* (seed-corn maggot) on beans; *Crioceris asparagi*, L., and *C. 12-punctata*, L. (asparagus beetles) on asparagus; *Macrobasis unicolor*, Kirby (ash-grey blister beetle) on potato, beans, peas, beets, etc.; *Systena frontalis* (red-headed flea-beetle) on potato, aster, chrysanthemums; *Acyrthosiphon* (*Macrosiphum*) *pisi* (pea aphis); *Psila rosae* (carrot rust fly).

Fruit trees were attacked by *Lepidosaphes ulmi*, L. (oyster-shell scale), *Cydia pomonella* (codling moth), and *Taxonus* (*Ametastegia*) *glabratus*, Fall. (dock sawfly) on apples.

Greenhouse and garden plants were also injured by *Poecilocapsus lineatus*, F. (four-lined leaf bug) on aster, dahlia, etc., and *Diarthronomyia hypogaea*, Lw. (chrysanthemum midge).

COSENS (A.). **Reports on Insects of the Year; Division no. 3, Toronto District**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 14–16. [Received 10th October 1916.]

The following injurious insects were reported:—Tent caterpillars [*Malacosoma*] on choke cherry and other native trees and on cultivated fruits; *Psila rosae* (carrot rust fly) on carrots; *Trichiocampus viminalis*, Fall., on California poplar; *Recurvaria nanella* (lesser bud-moth) on pear and apple; several species of Aphids on roses, spiraea, nasturtium, etc.; *Dasyneura torontoensis*, Felt, a new species causing root galls on *Maianthemum canadense*, F. (false Solomon's seal) and grasshoppers including *Melanoplus femur-rubrum*. The last-named was parasitised by Nematodes belonging to the genera *Gordius* or *Mermis*.

MORRIS (F. J. A.). **Reports on Insects of the Year; Division no. 5, Port Hope District.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 17–21. [Received 10th October 1916.]

Insect pests recorded include:—Tent caterpillars [*Malacosoma*]; *Lepidosaphes ulmi* (oyster-shell scale) on wild and cultivated apples; *Eriocampoides limacina* (*Selandria cerasi*) (pear slug) on cherry;

Crambus spp. in meadows; tussock caterpillars [*Hemerocampa*] on horse-chestnuts; *Saperda tridentata* on elm; and *Blepharida rhois* on sumach.

Ross (W. A.). **Reports on Insects of the Year; Division no. 7, Niagara District.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916. pp. 21–24. [Received 10th October 1916.]

The following injurious insects were recorded:—*Aphis sorbi*, *A. pomi*, and *A. avenae*, on apple; *Psylla pyricola* (pear psylla); *Aegeria pictipes* (lesser peach borer), attacking the trunk and larger branches of peach trees; *Myzus cerasi* (cherry aphis) on sweet cherry; *Byturus unicolor*, destroying the flowers and foliage of raspberry; *Monophadnus* (*Monophadnoides*) *rubi* (raspberry sawfly), on the foliage of raspberry; *Rhopalosiphum ligustri* (privet aphis, on privet; *Crioceris asparagi* (asparagus beetle). The last-named was heavily parasitised by the Chalcid, *Tetrastichus asparagi*. Two generations of *T. asparagi* were observed, adults of the first appearing early in June, and those of the second late in July.

Caesar (L.). **Insects of the Season in Ontario.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 29–33. [Received 10th October 1916.]

Insect pests recorded during 1915 were:—*Cydia* (*Carpocapsa*) *pomonella* (codling moth); *Conotrachelus nenuphar* (plum curculio); *Aspidiotus perniciosus* (San José scale); *Eriophyes pyri* (blister mite); *Cacoecia rosaceana*, *C. argyrospila* and *C. semiferana* (leaf-rollers); the Capsids, *Neurocolpus nubilis*, *Paracalocoris colon*, *Lygidea mendax* and *Heterocordylus malinus* on apples; *Malacosoma americana* and *M. disstria* (tent caterpillars); *Alsophila pometaria* (fall canker worm) on American elm, birch, oak, basswood; *Psylla pyricola* (pear psylla); *Eriosoma* (*Schizoneura*) *lanigerum* (woolly aphis) on apples; *Myzus cerasi* (black aphis) on cherry; *Aegeria* (*Sanninoidea*) *exitiosa* (peach borer) in peach; *A. pictipes* (lesser peach borer); *Macrodactylus subspinosus* on grapes; *Tetranychus pilosus* (red spider) on plum and apple; *Haltica chalybea* (grape-vine flea-beetle) on grapes; *Typhlocyba comes* (grape leaf-hopper) on red grapes in the Niagara district; *Monophadnus rubi* (raspberry sawfly) on raspberry; *Aegeria tipuliformis* (imported currant borer) on currants; *Sidemia* (*Hadena*) *devastatrix* (glassy cutworm) on wheat and barley; *Anthonomus signatus* (strawberry weevil); *Hylemyia antiqua* (*Pegomyia ceparum*) (imported onion maggot); Cercopidae (spittle bugs) on meadow grass; and *Trichiocampus viminalis*, Fall. (poplar sawfly) on Carolina poplar.

Pupae of the forest tent caterpillar [*Malacosoma disstria*] were parasitised in some localities to an extent of 90 per cent. by the Sarcophagid, *Sarcophaga aldrichia*, Parker. Eggs of the Tachinid, *Doryphorophaga* (*Phorocera*) *doryphorae* were observed on the Colorado potato beetle [*Leptinotarsa decemlineata*] in one district. This is a common parasite of the potato beetle; the eggs are deposited on the host during June, and nearly full-grown larvae have been found early in July. Eggs and adults have again been observed in the middle of September.

CAESAR (L.). **The Imported Willow and Poplar Borer or Curculio** (*Cryptorrhynchus lapathi*, L.)—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 33–40, 3 figs. [Received 10th October 1916.]

An outbreak of *Cryptorrhynchus lapathi* occurred during the summer in the eastern part of Toronto Island. Investigation showed that this insect is widely distributed in the Province, especially in the southern part. The species of poplar preferred are *Populus candicans* and *P. balsamifera*, and to a less extent, *P. deltoides*. Among willows, the most severe injury is caused to several native species, including the scrub willows and *Salix fragilis* (crack willow). In Europe, *C. lapathi* attacks several species of willow and poplar and a few species of birch and alder, including *Alnus incana*. In the United States, almost all native and imported willows and poplars are injured and, in addition, *Betula pumila* and *B. nigra*. Damage is caused by the larvae, which bore into the sapwood and heartwood of the host. In the case of old trees, tunnels are found in the lower branches, while in young trees the base of the trunk is attacked. Injured trees become weakened and are very liable to be broken off by strong winds. Adults have been taken in May and between the beginning of July and the middle of October. Feeding takes place on juices exuded from the points of exit and from punctures made in the young twigs. In captivity adults fed readily on ripe apples and peaches. Adults appearing in May probably oviposit in June, and oviposition continues till early in August. The eggs are laid singly in cavities at the base of a common puncture. The winter appears to be passed in either the egg or the larval stage. The larval galleries run nearly straight in the stem or branch and reach a length of from 2½ to 4 inches, pupation taking place at the inner end of the gallery. Distribution is effected by the adults, which are probably capable of considerable powers of flight, and by the transportation of poplars and willows from infested nurseries. Infested trees should be cut down and burned during the first or second week in June, after the oviposition of adults emerging in May. It is also advisable to plant varieties of willows and poplars that are less liable to attack, such as *Salix alba* (white willow), *S. lucida* (glossy willow), *Populus alba* (white poplar), and *P. tremuloides* (aspen).

FELT (E. P.). **Side Injury and Codling Moth.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 40–43. [Received 10th October 1916.]

Investigations into the causes of side-injury of apples in the western part of New York State have shown that a connection exists between this type of injury and late-hatching larvae of the first brood of *Cydia pomonella*. Larvae hatching from eggs deposited in late June or early July temporarily enter the surface of the developing fruit; this position is soon abandoned, and a migration to the blossom end occurs. This type of injury is prevalent in orchards along the south shore of Lake Ontario and is thus believed to be indirectly due to local climatic conditions. The minimum temperatures during the period of emergence of the adults are such that oviposition is prevented until late in

June. Sprayed orchards in one county showed injury varying from 25 to 35 per cent., while in unsprayed plots, injury varied from 30 to 37 per cent. These facts are sufficient to emphasise the need for thorough annual sprayings. In the discussion following the paper it was stated that a somewhat similar type of injury is caused in Nova Scotia by the budmoth [*Eucosma ocellana*].

Du Porte (E. M.). **Insects of Ste. Anne's, Que., Season of 1915.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 48–50. [Received 10th October 1916.]

An abstract of this report has already been published [see this *Review*, Ser. A, Vol. iv, p. 485].

Du Porte (E. M.). **The Occurrence of *Tychius picirostris* on Clover at Ste. Anne's, Que.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 50–52, 1 fig. [Received 10th October 1916.]

Tychius picirostris (clover-head weevil) was first observed on the leaves of red clover during May. Later in the season migration to the flower-heads took place, and in this position the weevils were found until the end of September. In Europe this species attacks the flower-heads of red clover, plantain and *Genista*, and in the United States has been recorded from New York and Massachusetts. This is the first occasion on which it has been recorded in injurious numbers in North America.

Parrott (P. J.) & Glasgow (H.). **The Leaf-Weevil (*Polydrusus impressifrons*, Gyll.) in New York.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 60–65. [Received 10th October 1916.]

Polydrusus impressifrons has been imported into the United States from Europe and at the present time has become established in three counties in New York State. The favourite food-plants are birch, willow, poplar, apple and pear, while elm, rose, linden and black locust are attacked to a less extent. Adult beetles emerge from the ground during the end of May and the beginning of June. In 1914, they were first observed on 26th May. Oviposition began about 30th May, eggs being placed in crevices of the bark of the living tree or of twigs lying on the ground. Eggs occurred either singly or in masses in positions exposed to sunlight. Larvae emerged in about 13 days and entered the soil to feed on the roots of the host. Pupation took place during the latter part of April and the beginning of May at depths varying from 2 to 3 inches below the surface. In the adult stage *P. impressifrons* feeds on the foliage. Methods of control include the use of arsenical sprays against the adults and thorough cultivation to destroy larvae and pupae.

Brittain (W. H.). **The Green Apple Bug (*Lygus invitus*, Say) in Nova Scotia.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 65–78, 3 plates, 1 table. [Received 10th October 1916.]

Lygus invitus, Say, is distributed throughout the fruit-growing districts of Nova Scotia. At the present time pear trees are most seriously injured, but damage to apples, although less severe, appears to be increasing in many localities. This insect apparently oviposits only on apple and pear, although adults have been observed feeding on plum, and nymphs on couch grass, timothy, red clover, dandelions, etc. During 1915, the first nymph emerging from overwintering eggs was observed on 24th May and the last on 10th June, the period of maximum emergence lying between 1st and 15th June inclusive. Transformation into the adult stage was complete by 7th July. The average duration of the nymphal stage was found to be 32 days and that of the adult during July, 5·41 days. The length of the adult stage, however, varies considerably, some females being found as late as 7th October. Eggs are deposited beneath the tender bark of pears and apples, especially of the latter, and were observed on 20th July and on subsequent occasions. Young nymphs feed mainly on the foliage of apple and pear, but occasionally puncture the shoots. In later stages the blossoms and young fruit are exclusively attacked. The nymphs are capable of very rapid movement; when disturbed, they conceal themselves in the leaf axils or drop to lower branches or to the ground. In several instances they have been known to attack man and the larvae of the fruit-worm, *Xylina* sp. In the adult stage great activity is shown on sunny days. The powers of flight are considerable, and specimens have been taken at a distance of a quarter of a mile from the point of release. Predaceous habits, similar to those of the nymph, may be exhibited in this stage. The preferred food is the fruit of pear, apples being attacked less frequently. Injury to the foliage of apple by the nymphs causes the formation of purplish areas, accompanied by a slight curling, and later of numerous small holes. Punctures in the twigs cause the exudation of gum and the formation of a swelling which may acquire a longitudinal crack. In cases of heavy infestation, young twigs and blossoms may die off as the result of the loss of sap. Injury to the fruit causes the exudation of gum, the formation of a corky scar over the punctured area, and failure to develop normally. The fruit often drops to the ground a few days after injury. In the case of pears, the injury is similar, but results in the formation of a black area around the punctures, the fruit becoming hard and unfit for use. Damage to the fruit of plum occurs at the end away from the stalk and causes a flow of gum. A list is given of the varieties of apple in order of their susceptibility to attack. Among pears, the Bartlett variety suffers most severely. Feeding experiments showed that nymphs in the second and third instar were able to complete their transformations on grape, elm, maple, sweet cherry, peach, red clover, strawberry, or couch grass. Leaves and blossoms of strawberry died as the result of attack, while couch grass showed evidence of wilting. Examination of several orchards seemed to show that injury was most severe in those which had been well sprayed and cultivated, but were, at the same time, closely planted with thickly growing trees.

The ant, *Formica fusca*, and spiders were apparently the only natural enemies of any importance. Spraying experiments were undertaken

in which Black Leaf 40, at a strength of 1 pt., 1½ pts., or 2 pts. to 100 gals. water, either alone or in combination with soap or lime-sulphur, was applied, in the case of apples, immediately before and after flowering, and in the case of pears, immediately after flowering and again five days later. Examination soon after spraying showed the presence of numerous dead, but no living nymphs on the trees. Examination two days later, however, showed many living nymphs to be present. Control measures must therefore include the spraying of the trees, the destruction of weeds which may serve as host plants, and the banding of the trees with tanglefoot to prevent fallen nymphs from reascending the trunks. Pruning should be properly carried out, so that all parts of the tree may be reached by the spray.

CRAWFORD (H. G.). **A Capsid attacking Apples** (*Neurocolpus nubilis*, **Say.**)—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 79–88, 6 figs. [Received 10th October 1916.]

The following Capsids attack apples in the Province of Ontario:—*Neurocolpus nubilis*, *Lygidea mendax*, *Heterocordylus malinus*, and *Paracalocoris colon*. Of these, only the first two are of much economic importance. *N. nubilis* has also been recorded from Quebec, New York, New Jersey, Maine, Colorado, California, Florida, and Panama. The eggs are deposited either singly or in pairs in the tissue at the base of a bud and in the axils of the leaves on new twigs of apple and sumach. Egg-laying probably extends over a period between about 15th July and 1st September, although the majority are deposited by 15th August. In 1915, hatching began about 27th May and the maximum emergence took place between 5th and 9th June, while isolated individuals appeared until about 13th July. The period of maximum emergence thus corresponded with the closure of the calices and the early development of the fruit of the apple. The duration of the nymphal stage was approximately a month, the first adult being seen on 30th June. An increase in the number of adults occurred until 15th July; after remaining constant for about two weeks, the numbers gradually declined, until all had disappeared by 7th September. Young nymphs were found on the underside of leaves and in unopened and rolled leaves. When the fruit reached a diameter of about ½ inch, the leaves were deserted and attacks on the young apples continued for about 10 days. At the end of this time, the majority of the nymphs migrated to food-plants at the base of the trees, these plants including red clover, curled dock, alsike clover, Canada blue grass, rye, evening primrose, etc. The majority of adults appeared on these hosts, and after remaining for about a week in this position, a small proportion appeared on the trees and fed on the buds in the leaf axils. Injury to the young fruit by the nymphs results in the formation of raised areas over the point of puncture. When these are very numerous deformation and stunting takes place. In one case, injured fruit rotted and fell, probably as the result of inoculation by the bugs with the spores of *Bacillus amylovorus*. The feeding of the adults leads to the death of many buds, and in cases where the twig is punctured, to the formation of a gall.

To control this pest, a system of clean cultivation should be practised and all weeds should be kept down until about the end of June. A spray consisting of Black Leaf 40, 1 part in 800 of water, with 2 lb. soap to every 40 gals., should be applied when the nymphs are sufficiently abundant. This treatment may be repeated after an interval of two weeks.

STRICKLAND (E. H.). **The Army Cutworm in Southern Alberta.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 93-97. [Received 10th October 1916.]

An outbreak of *Euxoa auxiliaris* occurred during 1915 over a considerable area in southern Alberta. Investigations into the habits and life-history of this cutworm show that the eggs are deposited in September and October in the soil of weed-infested fields. Hatching takes place in autumn and the immature larvae hibernate in the soil. Activity is resumed in spring; during 1915, larvae were first observed on 7th April and were abundant three days later. The food-plants include practically all weeds, as well as field and garden crops. In one instance the bark of young twigs of Manitoba maples was attacked. When food is plentiful, the larvae remain in the soil during the daytime, emerging to feed at dusk. In cases of scarcity of food, migration occurs mainly at night. The direction of migration was found to be towards the north-west, *i.e.*, away from the sun. The marching habit was assumed during the daytime only under stress of severe hunger. Pupation takes place in earthen cells. Adults appear from the middle of June until the end of September or the beginning of October. The reactions to light are similar to those exhibited by the larvae. The direction of flight is more or less to the north. Aestivation may occur during the hottest part of the summer. Adults are attracted to a slight degree by artificial light in houses, but light-traps in the field have proved useless as a method of control. The larvae, however, are easily destroyed by the use of a poisoned bait, consisting either of shorts sweetened with beet molasses or green vegetation poisoned with Paris green. Where the larvae are observed to be abundant in fields which are being prepared for sowing, all weeds should be removed from the fields and a poisoned furrow prepared round them. The absence of food before the germination of the seed will cause a migration to the furrow. In the discussion following the paper, it was stated that fruit juice does not appear to increase the attractiveness of poisoned bait. The habit of ovipositing in the soil is said to be peculiar to southern Alberta. In British Columbia, the eggs of cutworms are deposited on leaves of various plants or on stems of trees, and not in the soil.

FERNALD (H. T.). **Life Zones in Entomology and their Relation to Crops.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto.* 1916, pp. 97-101. [Received 10th November 1916.]

North America may be divided into Tropical, Austral and Boreal zones, Canada lying almost entirely within the last-named, the southern portion only being included in the Upper Austral zone. The three zones differ in their flora and fauna. The elm-leaf beetle [*Galerucella luteola*], introduced into Baltimore about seventy-five years ago, has

now spread far northwards and has caused serious losses in New England. It thrives in the Upper Austral zone, but is absent from the mountains of Pennsylvania, though it occurs again to the west of them. In Massachusetts, this beetle is found in the south of the State and in the river valleys, but is absent from the northern higher parts. The San José scale [*Aspidiotus perniciosus*] is most abundant in the Upper and Lower Austral zones, but decreases in numbers further northwards. In the transition zone of the Boreal region, this species has however adapted itself to a certain extent to the lower temperature, but is never able to cause severe injury.

HEWITT (C. G.). **Progress of Entomology in Canada during 1915.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 119-123. [Received 10th October 1916.]

Successful work in controlling insect pests in the various provinces was carried out during the year. In Nova Scotia increased spraying along suitable lines resulted in the production of a larger quantity of better fruit than in previous seasons. Locust control was undertaken with very satisfactory results in Quebec, while in southern Alberta serious losses from injury by cutworms were prevented to a very considerable degree. The most important new pests discovered were *Taeniothrips pyri* (pear thrips) and *Eriophyes ribis* (currant bud mite), both in British Columbia. The need for increased accommodation for entomological work led to the erection of four new laboratories in the provinces of Nova Scotia, New Brunswick, Manitoba, and Alberta.

CHRYSTAL (R. N.). **The Life-History of *Chermes cooleyi*, Gillette, in Stanley Park, Vancouver, B.C.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 123-130, 9 figs. [Received 10th October 1916.]

Serious injury to Sitka spruce by *Chermes cooleyi* occurs in Vancouver. Hibernating stem-mothers of this species are found on the twigs, either immediately below the terminal bud, or as far as 3 inches down the stem. In 1915 oviposition began during the first week in April, several hundred eggs being laid in masses by a single individual. Hatching took place in five or six days. The young take up a position at the inner bases of the young needles, with the result that gall formation quickly follows. In this locality, as a rule, the gall completely encircles the apex of the twig, generally involving the subsequent death of the whole twig. The last moult takes place outside the gall on one of the needles, the earliest date of emergence from the gall in 1915 being 25th June. The winged form that arises migrates to *Pseudotsuga mucronata* (Douglas fir). Oviposition soon follows, from 100 to 150 eggs being laid. Hatching occurs in about seven days, and the young remain without any apparent change on the needles until the following spring. Activity is then resumed; from 30 to 40 eggs are laid on the needles of the Douglas fir, and these hatch at the end of May or the beginning of June. This generation on Douglas fir is dimorphic; about half the number of individuals acquire wings and migrate to Sitka spruce, while the remainder increase in size, secrete

wax and oviposit on the fir. This form is *Chermes cooleyi* var. *coweni*, Gill. The young hatching from these eggs remain on the Douglas fir until the following spring, when they become stem-mothers. The migrants to the Sitka spruce deposit from 30 to 40 eggs, the young from which probably become the stem-mothers for the new broods on the spruce in the following spring. Injury to Douglas fir takes the form of a curling and bending of the needles at the point of attack, but does not appear to affect the health of the tree to any extent. The natural enemies include larvae of Syrphid flies and certain Coccinellids attacking the pupae within the galls, though they do not occur in sufficient numbers to control this pest effectively.

TREHERNE (R. C.). **The Cabbage Maggot—Autumn Development in British Columbia.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 130–139, 3 tables, 2 charts. [Received 10th October 1916.]

Three complete and overlapping generations of *Chortophila* (*Phorbia*) *brassicae* usually occur each year in the vicinity of Agassiz. The observations recorded in this paper were made on and after 1st September and thus deal with the third and perhaps with a partial fourth generation. Collections of puparia were made in order to determine the stage in which the winter was passed. Under both field and laboratory conditions adults emerged freely from the soil during September. In the laboratory the duration of this stage varied from 7 to 25 days. Adults emerging between 20th and 27th September and fed on syrup and water lived in some cases until 8th October, when a sudden fall in temperature to 33° F. occurred. No flies emerged from puparia in the laboratory after 27th September. In the field emergence continued until October and adults were active as late as 22nd October. Egg-laying records showed that the number of eggs deposited on cauliflowers in the field far exceeded that on cabbages. Eggs collected between 13th and 26th September and placed in the soil round a plant yielded larvae of from 3 to 4 mm. long by 25th October. These and larvae hatching out later would certainly be able to reach the pupal stage before the approach of very severe weather, which does not usually set in until the end of December or the beginning of January.

TREHERNE (R. C.). **The Cabbage Maggot in British Columbia** (*Phorbia brassicae*)**; the Natural Control by Parasites and Predaceous Insects.** —*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 140–145, 3 tables. [Received 10th October 1916.]

Oviposition by *Chortophila* (*Phorbia*) *brassicae* in the Lower Fraser Valley is continuous from the beginning of April until October. record of the total number of eggs deposited on certain plants between 17th April and 26th October was made, and of these about 2,500 were tested to determine their fertility. Larvae emerged from more than 80 per cent. Field records show that the actual number of larvae and pupae present falls considerably below this percentage. This is due to a heavy mortality among young larvae and to the presence of parasitic and predaceous enemies. The only parasite at present known in the

district under consideration is the Cynipid, *Cothonaspis gillettei*, which occurs in small numbers only and is not an important controlling factor. Among the predaceous enemies are, a red mite, the Carabids, *Celia farcta*, Lec., *Bembidion mutatum*, G. & H., *B. trechiforme*, Lec., *Platynus cupreus*, Dej., and *Pterostichus lucublandus*, Casey, and the Staphylinids, *Orus punctatus*, Casey, *Xantholinus hamatus*, Say, and *Hesperobium californicum*, Lec. These beetles probably constitute a very important controlling factor.

SANDERS (G. E.). **Some of the Methods followed in Nova Scotia in Controlling the Brown-tail Moth.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 147–152. [Received 10th October 1916.]

The brown-tail moth [*Euproctis chrysorrhoea*] in Nova Scotia occurs mainly on fruit trees, the only forest or ornamental trees which are attacked being those growing in or near orchards. In those countries in which the orchards are small and scattered, control by the collection of nests in winter has proved very effective. Where there are large continuous orchards or an abundance of wild seedling apples, control is rendered much more difficult. The winter dropping of nests varies from 10 to 25 per cent. of the total number. The larvae in such nests appear to withstand the winter better than those in nests remaining on the trees. As most of the nests drop in November and December, their collection begins on 1st November. Control measures also include educational work, spraying campaigns, and the liberation of parasites, notably *Apanteles lacteicolor*. With regard to spraying, it has been demonstrated that lime-sulphur and lead arsenate, applied between 28th June and 15th July, remains adherent to the leaves until after the emergence of larvae in August.

TOTHILL (J. D.). **Observations on the Brown-tail and Gipsy Moth Situation in Relation to Canada.**—*46th Ann. Rept. Entom. Soc., Ontario, 1915, Toronto,* 1916, pp. 152–153. [Received 10th October 1916.]

The brown-tail moth [*Euproctis chrysorrhoea*] is now endemic in the transition zone in Nova Scotia. This indicates that this insect could become a serious pest in other parts of Canada within the same zone, such as British Columbia, Alberta, Ontario, Quebec, New Brunswick and Prince Edward Island. The gipsy moth [*Lymantria dispar*] is also a potential pest in the same provinces; it hibernates successfully in the northern parts of Maine and if introduced into Canada would find an abundant food supply. Parasites are thus being introduced primarily to prevent the establishment of the moths in these regions.

BURGESS (A. F.). **The Work carried on in the United States against the Gipsy and Brown-tail Moths.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 153–155. [Received 10th October 1916.]

The work carried out in New England against the gipsy and brown-tail moths not only aims at control, but also at preventing their spread

outside the territory at present infested, which has been placed under quarantine. All plant products, as well as stone and quarry products, are inspected before being sent out of the quarantine area. For the past three years inspectors have been stationed at points where long distance trains pass out of the infested territory, in order to examine them and destroy any brown-tail moths that might be attracted to the lights. Large numbers have been killed as a result of these operations. In addition to the parasites, *Apanteles lacteicolor*, *Compsilura concinnata* and *Calosoma sycophanta*, two parasites of gipsy moth eggs, *Anastatus bifasciatus* and *Schedius kuvanae*, are doing excellent service in the infested areas.

Gibson (A.). **Locust control work with poisoned baits in eastern Canada in 1915.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 156–162, 3 figs. [Received 10th October 1916.]

In 1915, *Melanoplus atlantis*, Riley (lesser migratory locust) was again very abundant in Ontario and Quebec provinces, *Camnula pellucida*, Scudd., being less numerous. New poisoned baits, which had not previously been used in Canada under field conditions, were successfully employed. The results of nine experiments are tabulated with particulars of the crop, infestation, cost, etc. A higher death-rate per square yard was obtained where oranges were used to flavour the bait, one of two such formulae being:—Bran, 20 lb.; Paris green, ½ lb.; molasses, 2 qts.; oranges, 3; and water, 2½ gals. The second formula is identical, except that the amount of Paris green is doubled. Promising results were obtained with a new and very cheap bait containing sawdust instead of bran, viz.:—Sawdust, 20 lb.; Paris green, ½ lb.; salt, ½ lb.; water, 3 gals. Sawdust, if fairly free from pieces of wood, spreads easily, but in mixing it, care must be taken to add the water slowly, as sawdust does not absorb liquid as quickly as bran does.

Caesar (L.). **Leaf-rollers attacking apples.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto*, 1916, pp. 163–178, 9 figs. [Received 10th October 1916.]

In the course of an investigation into the life-history and habits of *Cacoecia argyrospila* (fruit-tree leaf-roller) in Ontario, *C. rosaceana* (oblique-banded leaf-roller) and *C. semiferana* (box-elder or Manitoba maple leaf-roller) were also found in the same orchard. About nine-tenths of the total injury was done by *C. argyrospila*, which is very abundant in the United States and which cannot be held to be a new pest in Ontario, though it has only become a very destructive one in some orchards in the last two or three years, evidently owing to the absence of natural enemies. Until the last two years, *C. rosaceana* was considered to be the commonest and most destructive leaf-roller in Ontario, where *C. semiferana* is very little known. *C. argyrospila* prefers apple trees, though a few individuals were noticed on pear, plum, peach, and oak. The larvae feed freely upon any succulent weed beneath the trees, and on the leaves and heads of clover and vetch in such positions. *C. semiferana* does not appear to have been previously recorded as attacking apples. Descriptions are given of the injury done,

and of the adult insects, and the early stages are compared with those of other species. All the species hibernate in the egg-stage on the trees and the eggs of all begin to hatch soon after the buds are beginning to burst. The first adult of *C. rosaceana* was seen on 10th June, those of *C. argyrospila* appearing about a fortnight, and those of *C. semiferana* three weeks later. *C. rosaceana* and *C. semiferana* seem to pupate almost invariably on the leaves, but fully half of the individuals of *C. argyrospila* pupated on weeds or in the grass. Apparently not more than 5 per cent. of the larvae were destroyed by parasites, and disease evidently played a greater part in control. Miscible oil sprays are the only ones giving really satisfactory results and should be used against the eggs. The application must be very thorough and should be made just when the leaf-buds are almost ready to burst, but so as to be completed before they have done so. Pruning renders spraying easier, cheaper and more effective. Autumn spraying seems to be useless, according to tests made in August against the eggs of *C. argyrospila* and *C. semiferana*. Many larvae and pupae may be destroyed by allowing fowls to run in the orchard and late cultivation will also kill numbers of them. Adults from pupae buried 2 inches deep by Mr. Crawford were found to be unable to emerge.

TREHERNE (R. C.). **A Preliminary List of Parasitic Insects known to occur in Canada.**—*46th Ann. Rept. Entom. Soc. Ontario, 1915, Toronto,* 1916, pp. 178-193. [Received 10th October 1916.]

This list includes the parasites of some of the more common pests in Canada, but does not claim to be complete, and it is hoped to supplement it from time to time. As a general rule, only the names of parasites recorded as definitely determined species are included.

OSBORN (H.) & DRAKE (C. J.). **The Tingitoidea of Ohio.**—*Ohio State University Bull., Columbus,* xx, no. 35, June 1916, 34 pp. (217–251), 11 figs., 2 plates. [Received 12th October 1916.]

This systematic paper on the lace-bugs of Ohio records 31 species, some of which are described as new.

GOSSARD (H. A.). **The Clover Leaf Tyer** (*Ancylis angulifasciana,* **Zeller**).—*Mthly. Bull. Ohio Agric. Expt. Sta., Wooster,* i, no. 6, June 1916, pp. 181–185, 2 figs. [Received 12th October 1916.]

The information in this paper has already been abstracted [see this *Review,* Ser. A, iv, pp. 188, 487].

WHELAN (D. B.). **The Bean-maggot in 1915.**—*Michigan Agric. Coll. Expt. Sta., East Lansing,* Entom. Dept. Circ. no. 28, February 1916, 4 pp. [Received 12th October 1916.]

During the summer of 1915, the bean-maggot [*Chortophila fusciceps* ?] caused more damage than ever before. In the past, the injury done by this species has often been confused with that of the onion maggot [*Hylemyia antiqua*] and the cabbage maggot [*Chortophila brassicae*]. The fly usually oviposits on the stems of plants just coming through the soil or on decaying vegetable matter, and the maggots

tunnel in the growing plants. There is reason to believe that two or more generations occur during the growing season. During this outbreak samples of beans and growing stems from an infested field were examined, and it was found that about 60 per cent. of the plants were killed before appearing above ground. This pointed to the maggots being present in the ground before the beans were planted and that they had migrated from the fresh manure which had recently been ploughed in. Examination of a number of bean-fields confirmed this, and it also appeared that, while beans were apt to suffer when planted on freshly turned clover land, especially if recently fertilised with undecomposed manure, they stood a much better chance of escape if the field was prepared early in the season and the maggots given time to develop and disappear before the beans were planted. Cultural methods therefore seem to provide the best control measure. Commercial fertilisers may be substituted for farmyard manure and repeated harrowing and perhaps rolling, especially where the soil is light, may be advantageous.

FERNALD (H. T.). **Report of the Department of Entomology.**—*28th Ann. Rept. Massachusetts Agric. Expt. Sta., Part I., Boston,* January 1916, pp. 65a–68. [Received 12th October 1916.]

The major portion of this report for 1915 is devoted to an outbreak of *Otiorrhynchus ovatus*, L. (strawberry crown girdler), which appeared in the spring in a State forest nursery, causing an estimated loss of over £3,000. The damage was first noticed on 13th May in beds of two-year-old white pines, the tops of which turned brown, larvae having girdled the stems and roots at from one to three inches below the surface of the ground. Entire beds were destroyed, while larger trees in blocks also showed considerable infestation. The attack was most severe on light and sandy soils. Besides white pine, other varieties, such as red pine, Scotch pine, *Juniperus virginiana*, blue, Douglas and Norfolk spruce, and even sugar maple seedlings of the two-leaf age, were attacked, in some cases severely. The larvae were evidently nearly mature and the weevils appeared by mid-June, reaching their maximum abundance about 7th July. The eggs proved difficult to discover, but a few were observed before the end of July and a few larvae appeared later, when further observation had to be discontinued. It therefore appears that, in this outbreak, at least some portion of the larval feeding occurred in the autumn and was resumed in the spring, while the adult period extended over several months. As pupation was imminent at the time of the first examination, it was advised that affected beds should be entirely stripped and thoroughly cultivated every two or three days in order to remove all food from the larvae and to break up the pupal cells. Examination at a later date showed numerous dead pupae, but indicated that at least some larvae had pupated lower than a harrow would reach. Boards, burlap and heaps of weeds were successfully used to trap the beetles, the last-named proving the most effective. These traps were most successful in hot, dry weather. To prevent oviposition near unaffected trees, the ground immediately round their stems was heavily sprayed with whale-oil soap solution (1 lb. soap in 4 U.S. gals. water), kerosene emulsion, and Black Leaf 40, in different parts of the nursery.

JEPSON (F. P.). **The Lantana Seed Fly (Agromyzidae).**—*Dept. Agric., Fiji, Suva*, Pamphlet no. 31, 22nd July 1916, 1 page. [Received 13th October 1916.]

The small black Agromyzid, the so-called "lantana seed fly," has been introduced into Fiji from Hawaii and is now so thoroughly established that it is not possible to find *Lantana camara* within several miles of Suva which does not display evidence of attack. Two boxes of infested lantana berries were sent from Hawaii, one at ordinary temperature and the other in cool storage to retard the development of the feeding larvae. Few of the latter emerged, while several flies were obtained from the former. A small Chalcid parasite of this Agromyzid occurs in Fiji, but not in sufficient numbers to affect its spread seriously.

NOWELL (W.). **A new Fungus on the Green Scale.**—*Agric. News, Barbados*, xv, no. 375, 9th September 1916, p. 302.

A fungus hitherto unrecorded, and as yet undescribed, has been found on *Coccus viridis* (green scale) infesting lime twigs from Montserrat. It is nearly related to *Empusa fresenii*, Nowak, and has also been reported from Cuba.

QUINN (—). **Black aphis of the peach.**—*Jl. Dept. Agric. S. Australia, Adelaide*, xx, no. 1, August 1916, p. 28. [Received 13th October 1916.]

A remedy recommended for the black peach aphis [*Aphis persicae-niger*] is a strong tobacco and soap wash, into each gallon of which one pint of resin compound is mixed. The tobacco wash is made by simmering tobacco waste (2 to 4 oz. per gallon) for a couple of hours in hot water, or steeping it for a couple of days in cold water. The liquor is then strained and 1 oz. of common soap is added per gallon. Resin compound is made by boiling 1 lb. powdered resin, 1 lb. washing soda, and ½ lb. soap in each 5 gals. of water, until all are dissolved into a strong brown liquid. This may be kept almost indefinitely, and used as required. It may be made more concentrated for keeping and diluted for use. If this wash can be applied fairly warm, its insecticidal powers are increased.

CRIDDLE (N.). **Some Stem Maggots attacking growing Grain.**—*Agric. Gaz. Canada, Ottawa*, iii, no. 6, June 1916, pp. 501-507, 3 figs. [Received 16th October 1916.]

In Canada, many species of Chloropids thrive both in wild grasses and in cultivated cereals, the introduction of which, by providing an abundance of food, may be held to have transformed them into pests of considerable magnitude, though their injury is usually overlooked by the average farmer. Close inspection of spring wheat makes it possible to determine the agent; the larvae usually attack the central shoot, cutting it off near its base, while the outer leaf nearly always remains green. Though this much resembles the injury by the Hessian

fly [*Mayetiola destructor*], the plant when attacked by the latter usually withstands the infestation better in the first instance and, in dying, gradually changes to blueish green and then to yellow and brown. In the succeeding generations, the injury by these flies is quite unlike that of *M. destructor*, the former still preferring the lower portion of the plant, while the summer attack of the latter can always be recognised by the bending of the straws just above one of the joints, usually the second. *Meromyza americana* (greater wheat-stem maggot) is the only Chloropid likely to be confused with the Hessian fly at this time. In the summer brood it attacks plants just above the topmost joints, causing "white heads," but never a bending of the stems. Of the true *Oscinella* (*Oscinis*) spp. (lesser wheat maggots) only three have as yet been reared from growing grain in Canada, viz:—*Oscinella variabilis*, Lw., *O. coxendix*, Fitch, and *O. dorsata*, Lw. Several others, however, occur in native grasses. Both *O. variabilis* and *O. coxendix* are abundant in Canada. The latter was observed in Manitoba in millions upon sheaves of oats in August. It was also the commonest species throughout the autumn, being collected up to the time of the first winter snow. As the flies are again plentiful within 24 hours of the departure of snow in spring, it may be concluded that *O. coxendix* hibernates as an adult. These flies are more numerous in some fields than in others. Summer-fallow upon which no self-sown plants are permitted will be less liable to attack in the following spring than similar land upon which there was an autumn growth of any grain. As a rule, the most severely infested fields are grass lands that have been ploughed late in autumn or in the spring and then sown with cereals. Grain fields adjoining grass lands are also apt to suffer, but not to the same extent. Winter wheat or rye is usually more severely attacked, owing to the fact that the pests are able to establish themselves in the crops during the previous autumn and on emerging in May find plenty of food at hand. Preventive measures, based on these facts, are the only remedy under ordinary conditions.

WEISS (H. B.). **The Distribution of the Periodical Cicada in New Jersey (Hem., Hom.).**—*Entom. News, Philadelphia*, xxvii, no. 8, October 1916, pp. 337-340, 1 plate.

The detailed distribution of *Tibicen septemdecim* (periodical cicada) in New Jersey is given, the infested areas being shown in a series of small maps.

BAKER (A. C.). U.S. Bur. Entom. **The Identity of** *Eriosoma querci*, **Fitch (Aphididae, Hom.).**—*Entom. News, Philadelphia*, xxvii, no. 8, October 1916, pp. 359-366, 1 fig.

A careful study of the European literature and of material from several European countries, as well as from Madeira and Japan, has proved that the species of *Anoecia* found upon *Cornus* in America is distinct from *A. corni*, F., of Europe, contrary to what has been hitherto believed. The American form winters upon plants of the same genus as does the European species and also migrates in summer to roots of grasses. The Japanese form seems to agree with the European.

Since the American form is distinct it has been necessary to ascertain its correct name. Two species described by Walsh in 1862, *A. cornicola* and *A. fungicola*, are the same species and identical with that common upon *Cornus*. Fitch, however had described in 1858, *Eriosoma querci* from oak in Illinois; this description agrees fairly with the American *Anoecia* upon *Cornus*, and four specimens from his collection confirm this. *Anoecia querci*, Fitch, is therefore the correct name for this species.

Cowen in 1895 referred to *A. querci*, Fitch, a species found by him upon oak in Colorado, and in 1911 Davis gave a more complete description and figures of this same species and placed it in *Phyllaphis*. Davidson in 1910 also recorded the insect from California. Gillette in 1914 renamed Cowen's species, *P. quercifoliae* and separated it from the eastern one. Specimens collected by the author in Virginia prove that the insect referred to by Davis, if not by Davidson, is a very distinct species, for which *Phyllaphis quercicola*, n.n., is suggested. It is, however, not a typical *Phyllaphis*.

Other synonyms of *A. querci* include *Rhizobius eleusinis*, Thos., *Schizoneura panicola*, Thos., and probably *Anoecia oenotherae*, Wilson. In Virginia the eggs of *A. querci* hatch about mid-April. By the end of the month the stem-mothers are mature and are producing the second generation, practically all of which become alate. The spring migrants are in the pupal instar by about 6th May, and in another three or four days migration begins and lasts until the first half of June, a few insects becoming alate at a time. Alate as well as apterous forms are produced during the summer upon the roots of various grasses. At the end of September the return migration begins and extends almost to the end of October. The sexual forms are deposited as the alate forms arrive, so that fresh migrants and nearly mature sexes occur upon the leaves at the same time. A few straggling migrants are on the trees even after the eggs are being laid. The author was unable to rear this species on the flowering dogwood, and could only induce it to feed upon the narrow-leaved dogwood. A description is given of the stem-mother, spring migrant, summer apterous, summer alate and autumn migrant stages, and the paper closes with a bibliography of 15 works.

CHRYSTAL (R. N.). **Forest Insect Investigation in Stanley Park, Vancouver, British Columbia.**—*Agric. Gaz. Canada, Ottawa*, vol. iii, no. 9, September 1916, pp. 794–798, 3 figs.

Chermes cooleyi (Sitka spruce gall aphis) is responsible for the death of a large number of sitka spruce (*Picea sitchensis*) in Stanley Park. Its life-history and migration to the Douglas fir (*Pseudotsuga mucronata*) is described [see this *Review*, Ser. A, iv, p. 523]. Experimental spraying proves that it is readily controlled by contact insecticides.

Dendroctonus obesus, Mann (Sitka spruce bark-beetle) was found in isolated patches damaging trees already weakened by *Chermes* or other causes. As many of the infested trees as possible were marked for removal, the broods being thus destroyed and the outbreak checked. This beetle spread from 6 to more than 24 trees in 1914.

Aphis abietina, Walk. (Sitka spruce green aphis) was found in considerable numbers on the needles in early spring. Winged migrants

appeared in early summer, but as yet, the secondary host plant has not been found. The injury is practically confined to the older needles, which become discoloured and fall off about the time the new ones are fully developed. This Aphid is readily controlled by spraying with contact insecticides.

From 1911 to 1913, caterpillars of *Therina* spp. caused vast damage to hemlocks, *Tsuga heterophylla*, but a great diminution of them was noticed in 1914, due to natural causes, chiefly parasitism by a Tachinid fly. A similar condition of affairs obtained in 1915 and in the summer of 1916. Isolated hemlocks have been infested by a species of *Chermes*, the foliage being covered in spring with a white woolly secretion from the stem-mothers. Death due to defoliation was caused in some cases. Further investigations are necessary into the life-history and habits of this species. Predaceous larvae of Syrphid flies were observed feeding on these insects in 1915 and have probably kept it under control. Many large Western cedars (*Thuja plicata*) have been found dead at the top, but this is probably due to fungus heart rot and no insect has been found doing serious damage to the foliage or bark. The Douglas fir, except that it acts as a secondary host of *Chermes cooleyi*, has been found to be practically immune from insect pests.

It was at first proposed to spray the trees with a high power spray which would reach to a height of 100 to 130 feet, using a contact spray (nicotine sulphate and soap) against *Chermes* and a poison spray (lead arsenate) against *Therina* caterpillars. Owing to the disappearance of the latter in 1914 and the fact that so many of the smaller spruces were too seriously injured to be worth saving, this idea was abandoned and methods of reafforestation were considered as being more practical. Trees attacked by bark-beetles and dead trees have been removed, and a general clearing away of debris will probably be undertaken while some system of replanting is being inaugurated. The introduction of exotic species of Conifers has been suggested as the basis for the future development of an arboretum which would be of considerable educational value.

FRYER (J. C. F.). **Plum Aphides.**—*Jl. Bd. Agric. London*, vol. xxiii, no. 7, October 1916, pp. 661–664, 2 plates.

The presence of *Aphis pruni* is easily recognised by the characteristic curling of the leaves, which are often covered with sticky honey-dew. It attacks all varieties of plum, damson and blackthorn, and to a slight extent peach, apricot and apple. The eggs, which are laid in autumn, hatch in early spring, giving rise to the purplish or brownish stem-mothers. These produce several generations of wingless females, until the end of June or July when winged forms appear. These desert the plums and migrate to host plants which have not been identified, but are believed to be weeds, such as thistles and ragworts. They return to the plums in autumn, giving rise to the sexual forms. The control measures recommended include spraying with lime-washes in February, or preferably March. Contact insecticides, such as emulsions of nicotine, quassia or paraffin may be effective, but it is essential that the spraying should be done either before the blossom has opened or after the petals have fallen, and in any case before the leaves have curled.

Hyalopterus pruni, F., occasionally does considerable damage, but is usually less harmful than *A. pruni*. It generally appears about midsummer on the underside of the leaves. It does not cause curling of the leaves, but secretes abundant honeydew, which may damage the leaves and fruit. It is characterised by its light green colour, waxy secretion, and late appearance. It attacks various kinds of plum, greengage, damson, peach, nectarine, apricot, and other species of *Prunus*. It also probably lives on reeds and grasses. Its life-history has not been followed in this country, but in Russia and in the United States it spends the winter and early summer on plums and the remaining months on reeds. The best control wash is said to be paraffin emulsion with liver of sulphur, washes which do not penetrate the waxy secretion being ineffective.

The hop-damson aphis (*Phorodon humuli* var. *mahaleb*) is found chiefly on damson, but may occur on other plums. Eggs are laid on damsons in autumn, producing forms in early spring which live for three to five generations on the damsons. Towards the end of May, winged forms appear which migrate to hops, returning to damsons in the autumn. Similar control measures may be used for this species as for *A. pruni*.

The following spray formulae are given:—Lime wash: Ten to twenty pounds of quick-lime to ten gallons of water. Lime-sulphur may be used in place of plain lime wash. Nicotine wash:—Nicotine, 98 per cent, $\frac{3}{4}$–1 oz.; soft soap, $\frac{1}{2}$–1 lb; water, 10 gallons. Paraffin emulsion:—Paraffin, one pint; soft soap, one pound; liver of sulphur, two ounces; water, ten gallons. Unless completely emulsified, paraffin emulsion is liable to scorch delicate foliage.

SMITH (H. S.). **Progress of the Sicilian Mealybug Parasite.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vol. v, no. 9, September 1916, pp. 349–350.

This report confirms the ability of *Paraleptomastix abnormis*, the Sicilian mealybug parasite, to live and thrive in California [see this *Review*, iv, Ser. A, p. 51], though time is necessary before the insect becomes sufficiently numerous to be of practical importance.

SMITH (H. S.). **Recent Ladybird Introductions.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento*, vol. v, no. 9, September 1916, p. 350.

During the past two months, two beneficial species of Coccinellids from Japan have been colonised in California. One of these is predaceous on Coccids and the other on Aphids, the former being *Chilocorus similis*. An attempt made several years ago to introduce this species into America apparently failed. It is said to feed principally on the San José scale [*Aspidiotus perniciosus*], but will feed on all Coccids, and has a preference for the DIASPINAE. The second Coccinellid has been identified as *Ptychanatis oxyridis*, which feeds voraciously on all species of Aphids.

MASKEW (F.). **Quarantine Division; Report for the month of July 1916.**—*Mthly. Bull. Cal. State Commiss. Hortic., Sacramento,* vol. v, no. 9, September 1916, pp. 351-353.

The following pests were intercepted during July 1916:—From Central America: *Pseudococcus* sp. and *Aspidiotus cyanophylli* on bananas. From China: Weevil larvae in sweet potatoes; Lepidopterous larvae in walnuts; *Pseudococcus* sp., and red spider on Litchi trees. From Honolulu: *Asterolecanium* sp., *Pseudococcus* sp., *Icerya* sp., and larvae of *Thrips* sp. on unknown plants; weevil larvae in tamarind seeds; *Diaspis bromeliae* and *Pseudococcus bromeliae* on pineapples; *Coccus longulus* on betel leaves. From Mexico: Weevils in avocado seeds; *Lepidosaphes gloveri* on limes; *Calandra* sp. on tamarinds; an unidentified Lepidopterous or Coleopterous larva on plums. From New Jersey: *Cerataphis* sp., and *Aspidiotus* sp., on orchids. From New York: *Diaspis boisduvali, Isosoma orchidearum* and Lepidopterous pupae on orchids. From Ohio: *Aleurodes* (*Dialeurodes*) *citri* on lemon trees. From Papute: *Morganella maskelli* on oranges and Dipterous larvae on coconut. From Pennsylvania: *Pseudococcus* sp., *Chrysomphalus aonidum, Aspidiotus* sp., and *Cerataphis lataniae* on palms. From Brazil: *Diaspis boisduvali* on orchids. From Central America: *Pseudococcus* sp., *Aspidiotus cyanophylli, Saissetia hemisphaerica, Aspidiotus cydoniae* and *Chrysomphalus scutifornis* on bananas. From Colombia: Cattleya fly [*Isosoma orchidearum*] and *Diaspis boisduvali* on orchids. From Colorado: *Pseudococcus* sp. on begonias. From Pennsylvania: *Eucalymnatus tessellatus, Aspidiotus cyanophylli* and *Chrysomphalus aonidum* on Robelinia palms; *Pseudococcus* sp., *Coccus longulus* and an unidentified Coccid on Crotons; *Pseudococcus* sp. on Dieffenbachias; an unidentified Coccid on Aralias; *Cerataphis lataniae, Aspidiotus lataniae, Chrysomphalus aonidum* and *Chrysomphalus aurantii* on Kentia palms. From Texas: *Cladosporium carpophilum* on peaches. From Venezuela: *Isosoma orchidearum* and *Diaspis boisduvali* on orchids.

WILDERMUTH (V. L.). **The New Mexico Range Caterpillar and its Control.**—*U. S. Dept. Agric. Washington, D.C.,* Bull. no. 443, 21st September 1916, 12 pp., 12 figs.

Hemileuca oliviae, Ckll. (New Mexico range caterpillar) is a serious pest in Eastern and Southern New Mexico, as it attacks cultivated crops as well as pasture land. At present it occurs chiefly in the north-eastern and south-central portions of New Mexico, to a slight extent in the adjoining parts of Texas, and was found in 1915 in small colonies in southern New Mexico. Though the moths have been found outside these limits, no caterpillars have been recorded elsewhere. A total abandonment of these areas of New Mexico was threatened owing to the ravages of this insect, the economic importance of which is considerable. The character of the injury is two-fold: first, by the eating down of the grass and consequent destruction of the pasturage, or in the case of cultivated crops, by devouring the leaves and sometimes the tender shoots; and secondly, by the scattering of poisonous spines over the ground by the caterpillars.

The eggs are deposited in a cylinder-shaped cluster round the stems of weeds or grass during September, October and November, the caterpillars hatching usually in May or June. The newly-hatched caterpillars feed in groups and when resting, or in cold wet weather, form conspicuous masses. They pupate in August or September, this stage lasting a month or six weeks.

The caterpillars are attacked by Dipterous parasites, including *Tachina mella*, and by Hymenoptera, including *Pimpla conquisitor*. Large numbers of the pupae are destroyed by skunks. Badgers, coyotes, mice and robins, as well as several ground beetles, ants and robber-flies also destroy this pest. The eggs are eaten by two different kinds of camel-crickets. Insect enemies of these groups, including the ground beetle, *Calosoma sycophanta*, have also been introduced from Massachusetts, Indiana, Kansas, Missouri and California. A wilt disease in some seasons destroys large quantities of caterpillars, but as this only occurs at rare intervals, it is not a sufficient check upon them.

Mechanical control measures which are suggested include:—Burning the pasture, rolling and brush-dragging the ground, and the use of sheep and turkeys. These measures are not practicable however on land of little value. Cereal crops are best protected by powdered arsenate of lead. When so treated, these must not be used for grazing until after heavy rains have fallen, and 30 days at least should elapse between spraying and their use as fodder.

MARLATT (C. L.). **House Ants: Kinds and Methods of Control.**—*U.S. Dept. Agric., Washington, D.C.*, Farmers' Bull. no. 740, 8th July 1916, 12 pp., 5 figs. [Received 19th October 1916.]

Nearly all the ants in North America that frequent houses are of tropical origin, and they are mostly Old World species. Those introduced from the Old World or South America have entered the country chiefly in ships' cargoes. In their native country they are probably outdoor species, but in temperate regions they are obliged to dwell in houses, hot-houses or mills in order to obtain adequate warmth.

The North American house ants fall into four groups, according to their country of origin. Tropical Old World ants are represented by the little red ant or Pharaoh's ant, *Monomorium pharaonis*, L. Originally a soil ant, it continues this mode of life in the tropics, and is only found in heated houses in temperate zones. *M. salomonis*, L., *M. destructor*, Jerd., and *M. floricola*, Jerd., have been reported occasionally in dwellings, particularly in the southern United States. *Solenopsis geminata*, F., subsp. *rufa*, Jerd., and *Pheidole megacephala*, F., are now fairly well established and are potential house pests. The latter, formerly an important house ant in Madeira, propagates rapidly in subtropical countries and will exterminate indigenous species. *Prenolepis longicornis* has acquired a footing in Florida, and has been reported as infesting large buildings in New York and Boston. It is believed to have originally come from India. The most important of imported tropical New World ants is *Iridomyrmex humilis*, Mayr, (Argentine ant), which is a serious pest in the citrus orchards of southern California and is the only species which causes large financial loss, the others being merely annoying. Four other South American

ants have gained a foothold in the southern and eastern United States as house pests. Of the native North American ants of temperate regions only one, *Solenopsis molesta*, Say, has become a true house-dweller. The carpenter ant, *Camponotus herculeanus*, L., subsp. *pennsylvanicus*, de G., usually found in logs or dead trees, sometimes occurs in wooden houses. This is, however, probably more or less accidental, and damage attributed to it may have been caused by *Leucotermes flavipes*. Four native and one imported species of garden and lawn ants have become house pests, notably *Monomorium minimum*, Buckley, and *Lasius niger*, L., var. *americanus*, Emery.

In the case of *M. pharaonis* and other imported species nesting in woodwork, where the nest can be reached, it may be destroyed by injecting a little bisulphide of carbon, kerosene, or gasoline into the opening by means of a syringe. Where the nest cannot be reached, precautions must be taken to isolate all attractive food. In certain cases repellents such as camphor or naphthaline may be used to drive the ants away, though their use is limited, as they cannot be placed near food, and less powerful repellents are of little use. Attractive baits, such as sponges moistened with sweetened water or a syrup of sugar and borax, are sometimes effective. A syrup made of one pound of sugar dissolved in a quart of water, to which 125 grains of arsenate of lead are added, is a more efficient remedy, as not only will the ants feeding on it eventually die, but from their storing it for food, the inmates of the nest also die. The addition of a little honey increases its attractiveness. Care must be exercised in the use of this remedy, as it is poisonous to man and animals. A similar remedy used against the Argentine ant consists of:—Granulated sugar, 15 pounds; water, $7\frac{1}{2}$ pints; crystallized tartaric acid, $\frac{1}{4}$ ounce; boiled together slowly for 30 minutes and allowed to cool. Sodium arsenite is then dissolved, $\frac{3}{4}$ oz. in $\frac{1}{2}$ pint of hot water, and when cool, added to the syrup and thoroughly stirred, $1\frac{1}{2}$ pounds of pure honey being also added to this mixture before use. The usual methods against termites may be used for the carpenter ant. The best measures are preventive, such as using only timbers previously impregnated with kerosene in the foundations of houses. Timbers not so treated, which have become infested, may be sprayed or soaked with kerosene.

EHRHORN (E. M.). **Report of the Division of Entomology of the Board of Agriculture and Forestry for the Fiscal Year ended June 30, 1916.** *Hawaiian Forester & Agriculturist, Honolulu*, xiii, no. 8, August 1916, pp. 286–288. [Received 27th October 1916.]

The work carried out embraced the inspection of fruit, vegetables and plants, the dissemination of advice and information relating to insect pests and plant diseases, and the collection, breeding and distribution of parasites of various pests. On all the main islands of the Hawaiian group a total of 239,012 parasites were bred and liberated, of which 186,512 were those of the fruit fly [*Ceratitis capitata*] and 52,500 those of the horn, house and stable fly. All the introduced parasites have been reared from materials collected in the field, except *Dirhinus giffardi* and *Galesus silvestrii*, which parasitise the pupa of the fruit fly.

REVIEW OF APPLIED ENTOMOLOGY.

SERIES A: AGRICULTURAL.

VOL. IV.

IMPERIAL BUREAU OF ENTOMOLOGY.

Honorary Committee of Management.

VISCOUNT HARCOURT, *Chairman*.

Head Office.—British Museum (Natural History), Cromwell Road, London, S.W.7.

Publication Office.—89, Queen's Gate, London, S.W.7.

ERRATA.

Page	22	line	24	for	" JAKOLEV "	read	YAKOLEV.
"	25	"	39	"	" *pomella* "	"	*pomonella.*
"	36	"	52	"	" *Cyclas* "	"	*Cylas.*
"	51	"	3	"	" *polleni* "	"	*pollini.*
"	56	"	14	"	" *Tryoglyphus* "	"	*Tyroglyphus.*
"	94	"	27	"	" *Sibina* "	"	*Sibine.*
"	108	"	50	"	" *Phylotreta* "	"	*Phyllotreta.*
"	116	"	23	"	" *mexicans* "	"	*mexicanus.*
"	118	"	32	"	" *brevicornis* "	"	*brevicomis.*
"	127	"	35	"	" *limonii* "	"	*limonum.*
"	132	"	40	"	" *Camptobrochus* "	"	*Camptobrochis.*
"	139	"	23	"	" DOBRODEEV "	"	DOBRODEIEV.
"	150	"	7	"	" *cinnamominus* "	"	*cinnamomeus.*
"	173	"	40	"	" 100 gals."	"	100 U.S. gals.
"	185	"	35	"	" *fallicus* "	"	*falicus.*
"	198	"	47	"	" *Tenthrecoris* "	"	*Tenthecoris.*
"	200	"	44	"	" *Rhyzobius* "	"	*Rhizobius.*
"	210	"	10	"	" *maroccannus* "	"	*maroccanus.*
"	222	"	9	"	" *Chilochorus* "	"	*Chilocorus.*
"	227	"	49	"	" *Attagenus undulatus* "	"	*Trogoderma khapra.*
"	237	"	16	"	" *gypactus* "	"	*gypaetus.*
"	237	"	19	"	" *Prospocoelus* "	"	*Prosopocoelus*
"	239	"	28	"	" *Tenebrioides* "	"	*Tenebroides.*
"	240	"	10	"	" *inquisitor*, Say "	"	*inquisitor*, Scop.
"	243	"	44	"	" *Coelopisthis* "	"	*Coelopisthia.*
"	245	"	35	"	" *Erranis tilaria* "	"	*Erannis tiliaria.*
"	257	"	16	"	" brushes "	"	bushes.
"	280	"	6	"	" *Ancylus* "	"	*Ancylis.*
"	291	"	21	"	" *Calandra oryza* "	"	*Calandra oryzae.*
"	306	"	25	"	" pp. 1–66 "	"	pp. 1–69.
"	321	"	20	"	" *Utethesia* "	"	*Utetheisa.*
"	326	"	3	"	" *Hypera variabilis* "	"	*Hypera punctata.*
"	331	"	43	"	" *Chaetophorus* "	"	*Chaitophorus.*
"	336	"	6	"	" MACLAINE "	"	MCLAINE.
"	343	"	25	"	" *tischerae* "	"	*tischeriae.*
"	344	"	33	"	" *Euplectus* "	"	*Euplectrus.*
"	345	"	32	"	" *hasipennis* "	"	*basipennis.*
"	349	"	32	"	" Hol."	"	Ol.
"	360	"	15	"	" *Dichactothrips* "	"	*Dichaetothrips.*
"	360	"	25	"	" *Dialeurodis* "	"	*Dialeurodes.*
"	361	"	20	"	" *subscrinita* "	"	*subcrinita.*
"	366	"	22	"	" *Pseudophycus* "	"	*Pseudaphycus.*
"	389	"	16	"	" *Calicratides* "	"	*Callicratides.*
"	392	"	5	"	" *Dichoetoneura* "	"	*Dichaetoneura.*
"	408	"	2	"	" *Euryloma* "	"	*Eurytoma.*
"	416	"	14	"	" *Mormordica* "	"	*Momordica.*
"	439	"	9	"	" *Attagenus undulatus* "	"	*Trogoderma khapra.*
"	442	"	24	"	" *azedarachta* "	"	*azadirachta.*
"	442	"	10	"	" *E. jamboso* "	"	*E. jambos.*

ERRATA—*cont.*

Page 450	line 32	for	"*Clostocerus*"	read	*Closterocerus*.
„ 458	„ 31	„	"*Syromastis*"	„	*Syromastes*.
„ 493	„ 34	„	"SIJAZOV (A.)"	„	SIJAZOVA (A.).
„ 495	„ 44	„	"GOLITZYN"	„	GOLITZIN.
„ 510	„ 33	„	"*Busaria*"	„	*Bursaria*.
„ 515	„ 4	delete (Jak).			
„ 515	„ 48	for	"Crwf.,"	„	Craw,
„ 534	„ 23	„	"*scutifornis*"	„	*scutiformis*.

INDEX OF AUTHORS.

A reference in heavy type indicates that a paper by the author has been abstracted.

GENERAL INDEX.

In the case of scientific names the page reference is cited only under the heading of the generic name.

When a generic name is printed in brackets it signifies that the name is not adopted.

A.

*This species was incorrectly identified; the right name is *Trogoderma khapra*, Arrow.

D.

E.

G.

H.

I.

J.

M.

N.

O.

P.

Q.

R.

S.

T.

U.

V.

W.

X.

Y.

Z.